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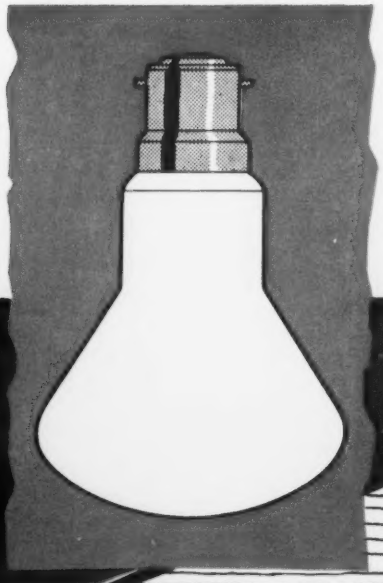

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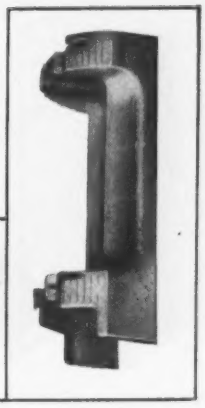
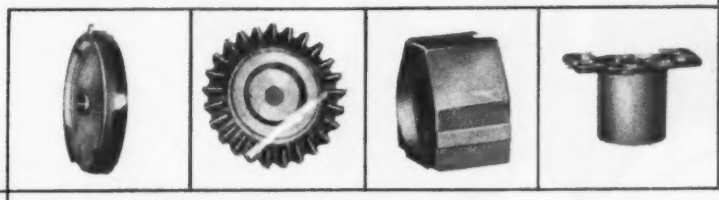
WOLVERHAMPTON die castings





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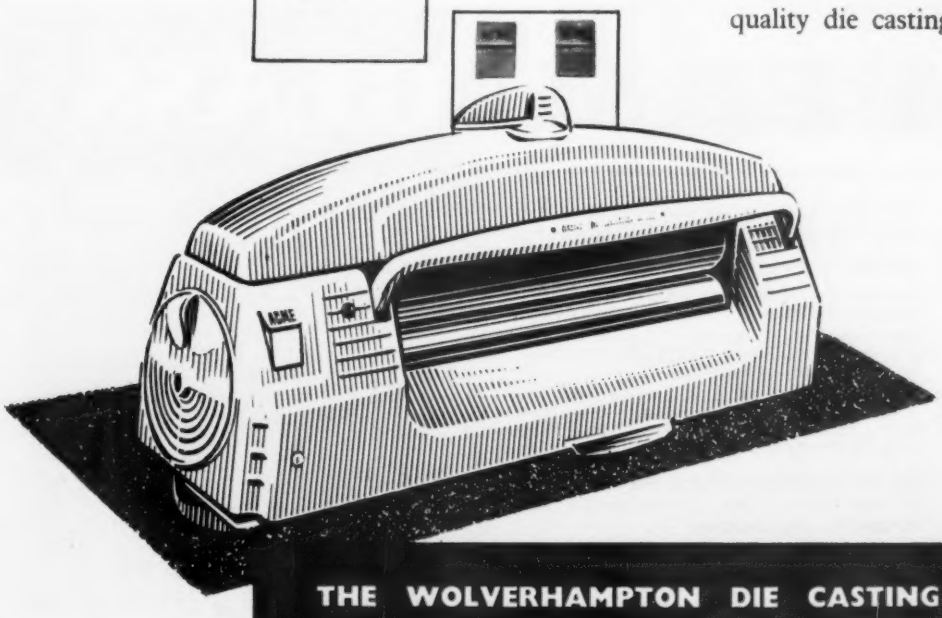

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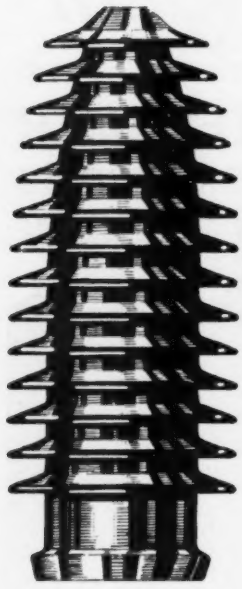

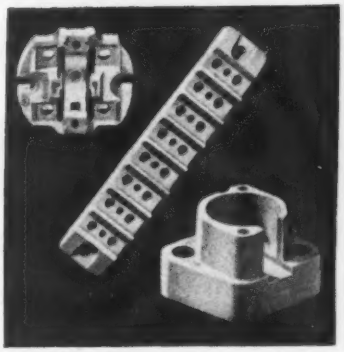

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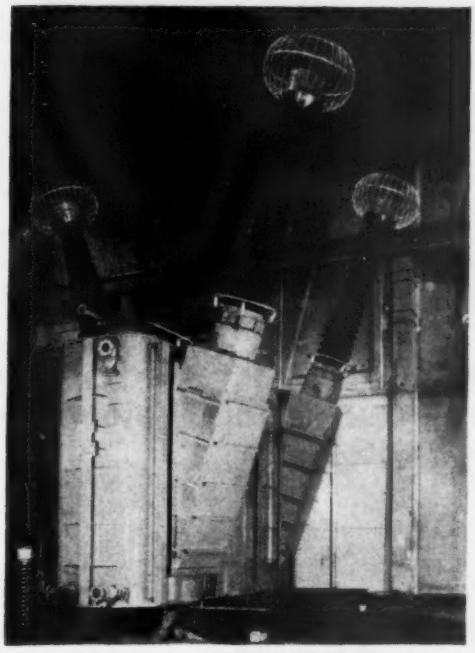

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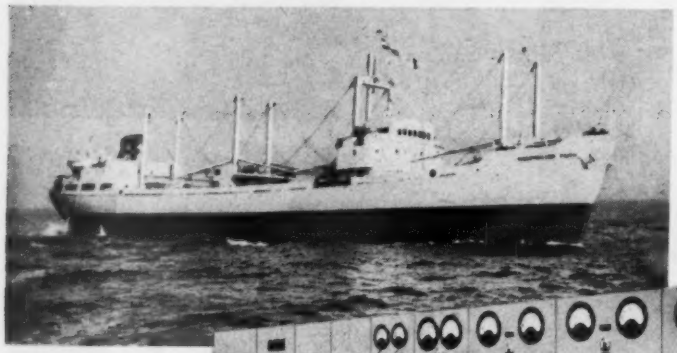
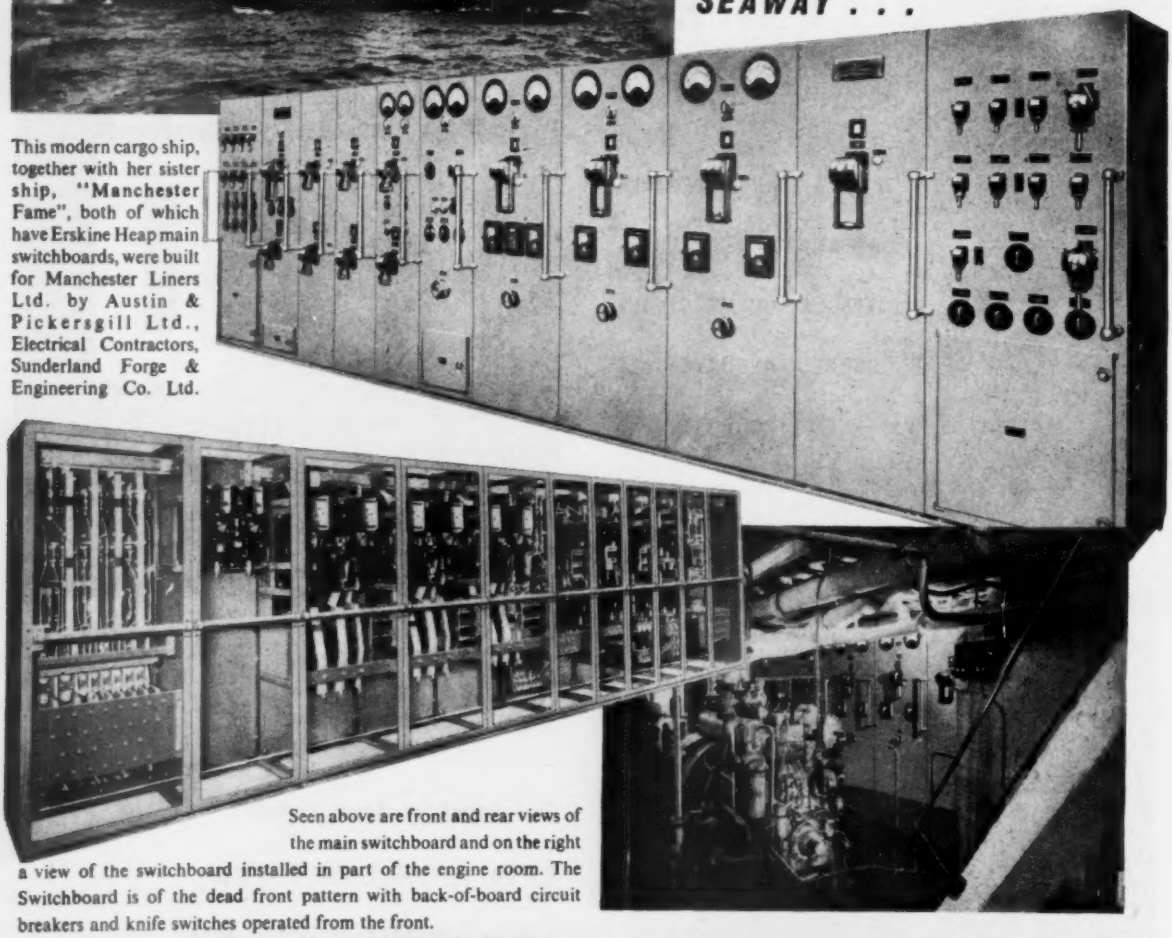


This modern cargo ship, together with her sister ship, "Manchester Fame", both of which have Erskine Heap main switchboards, were built for Manchester Liners Ltd. by Austin & Pickersgill Ltd., Electrical Contractors, Sunderland Forge & Engineering Co. Ltd.



Seen above are front and rear views of the main switchboard and on the right a view of the switchboard installed in part of the engine room. The Switchboard is of the dead front pattern with back-of-board circuit breakers and knife switches operated from the front.

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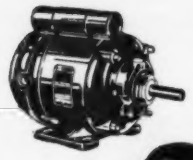

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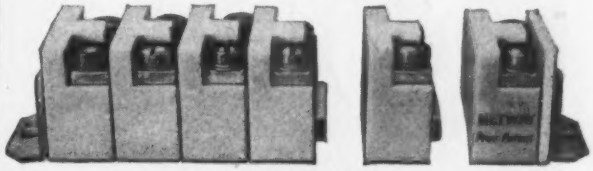

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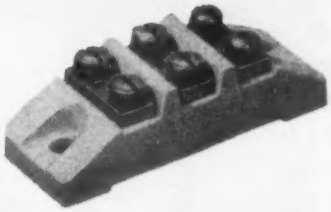

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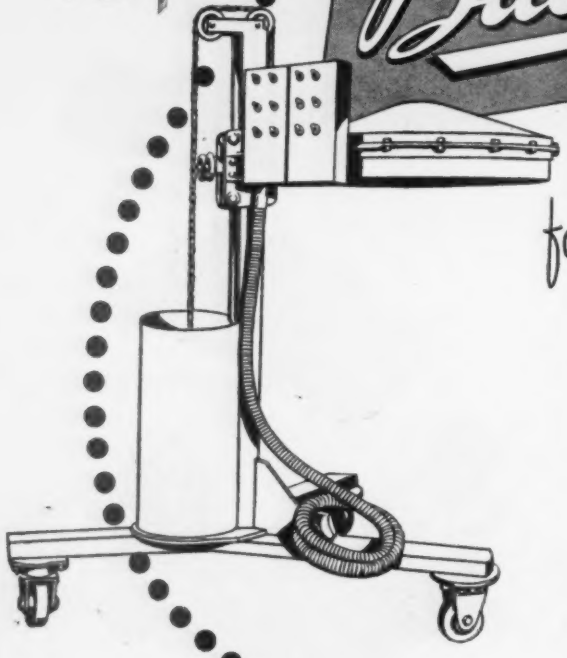

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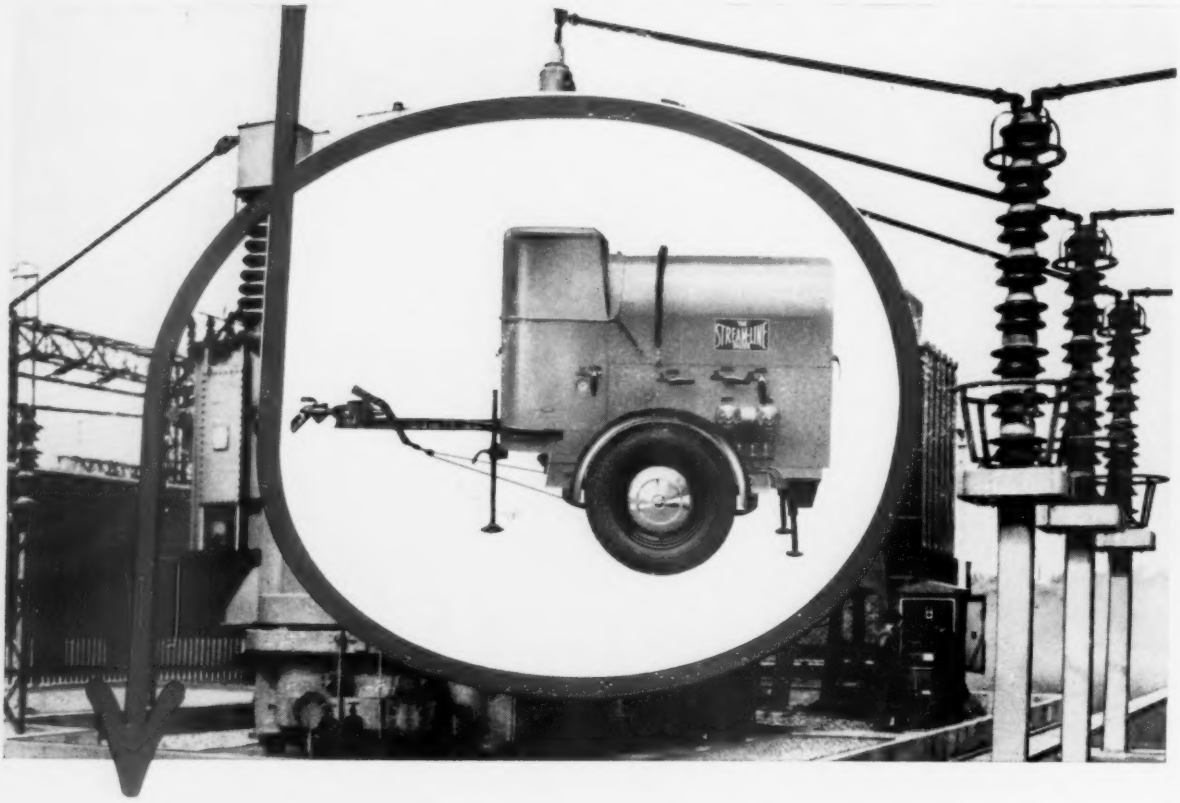
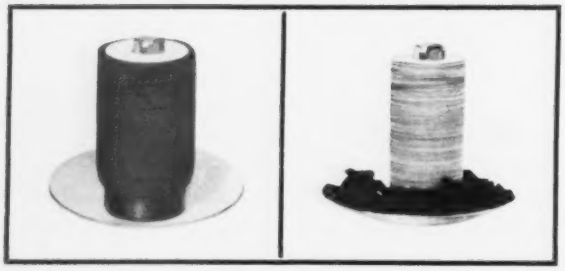


Loop in a Stream-Line filter



These illustrations show the Stream-Line filtering element built up of special paper discs under end pressure. Oil passes through the infinitesimal interstices between the discs leaving solid impurities at the paper edges. Instantaneous cleaning is carried out by a reverse flow of compressed air.

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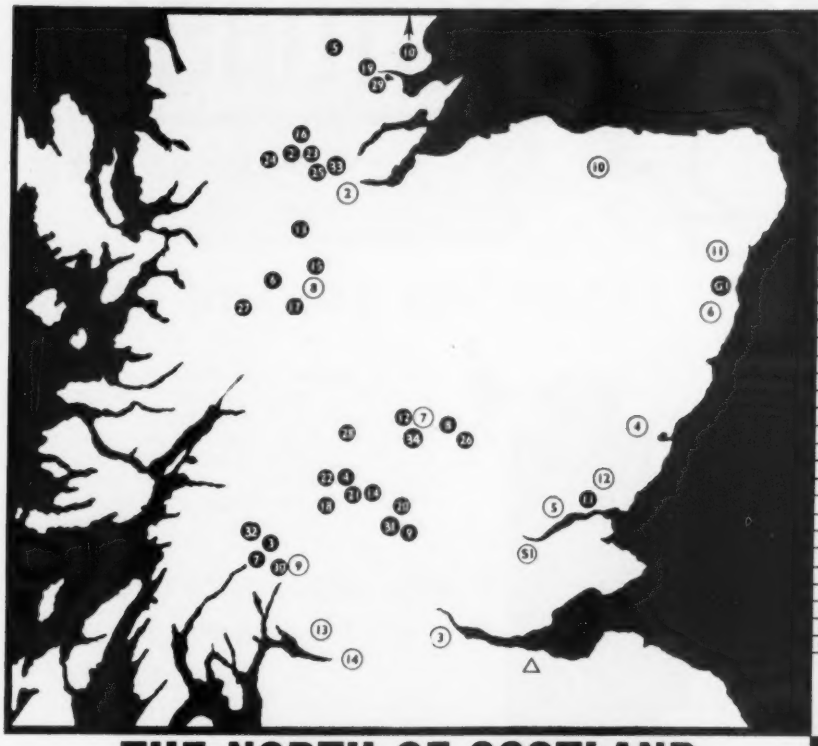

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G11	Dundee ◉	S11	Kintore
G12	Errochty ◉	S12	Milton-o-Craigie
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G14	Finlarig	S14	Windyhill (Transfer)
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G17	Invergarry		
G18	Killin		
G19	Lairg		
G20	Lednock		
G21	Lochay ◉		
G22	Lubreoch		
G23	Luichart		
G24	Mossford		
G25	Orrin		
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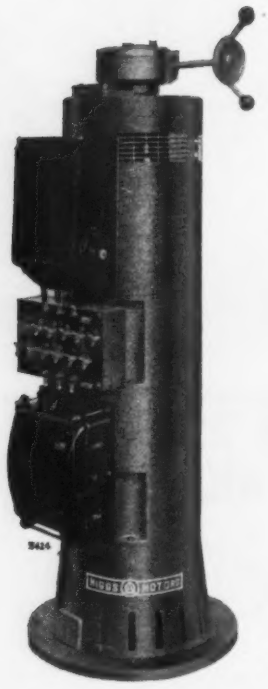

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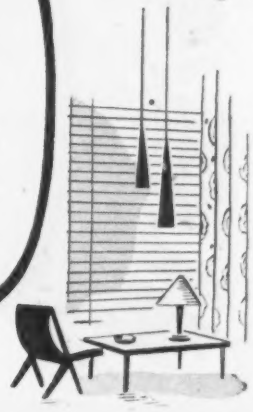

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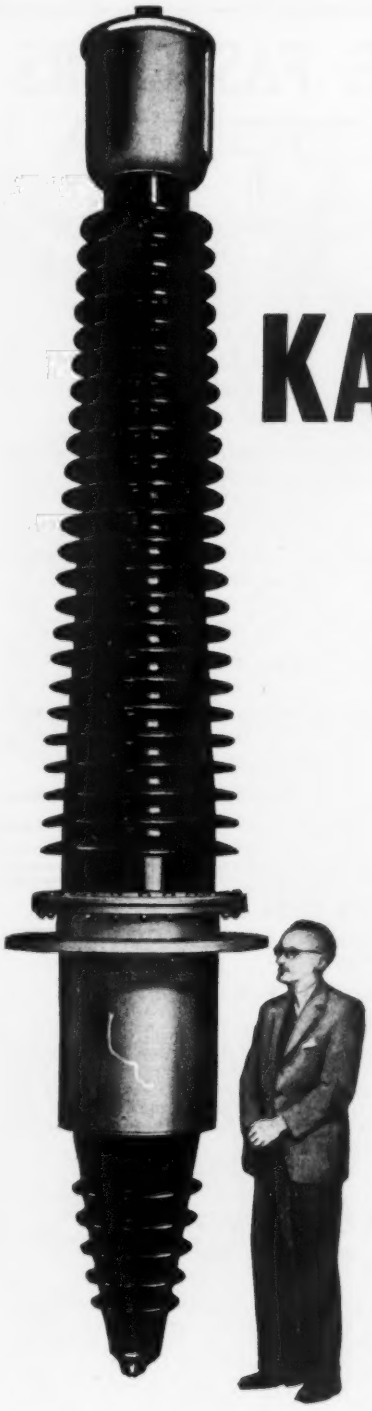

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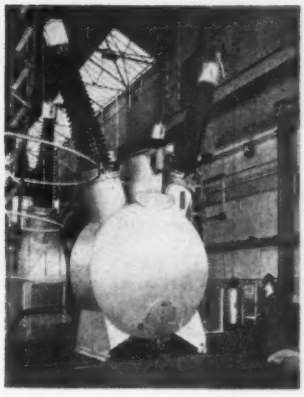

The illustrations show a complete 330 kV. bushing insulator and a 330 kV. circuit breaker, by courtesy of the B.T.H. Co.

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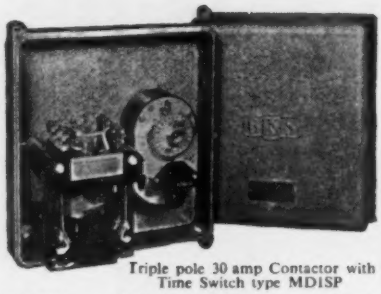

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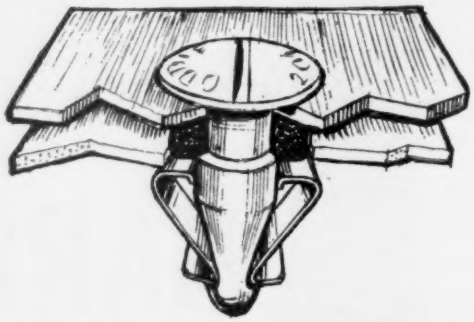

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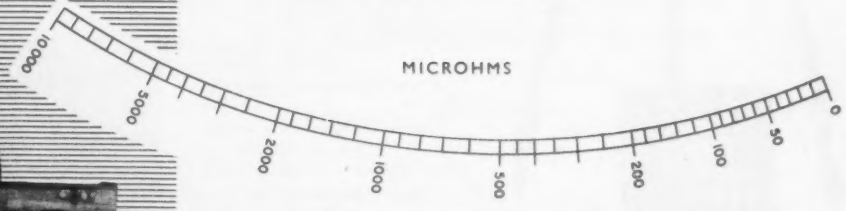

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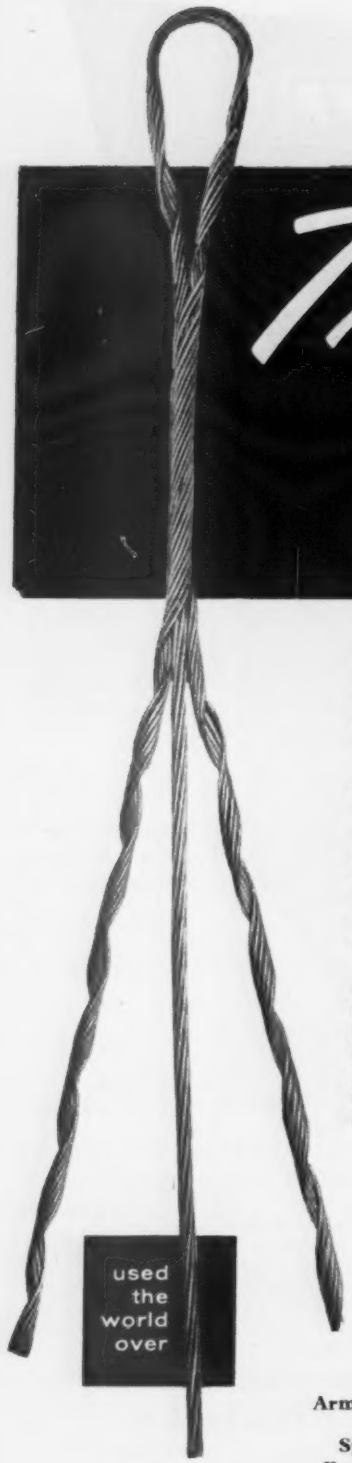

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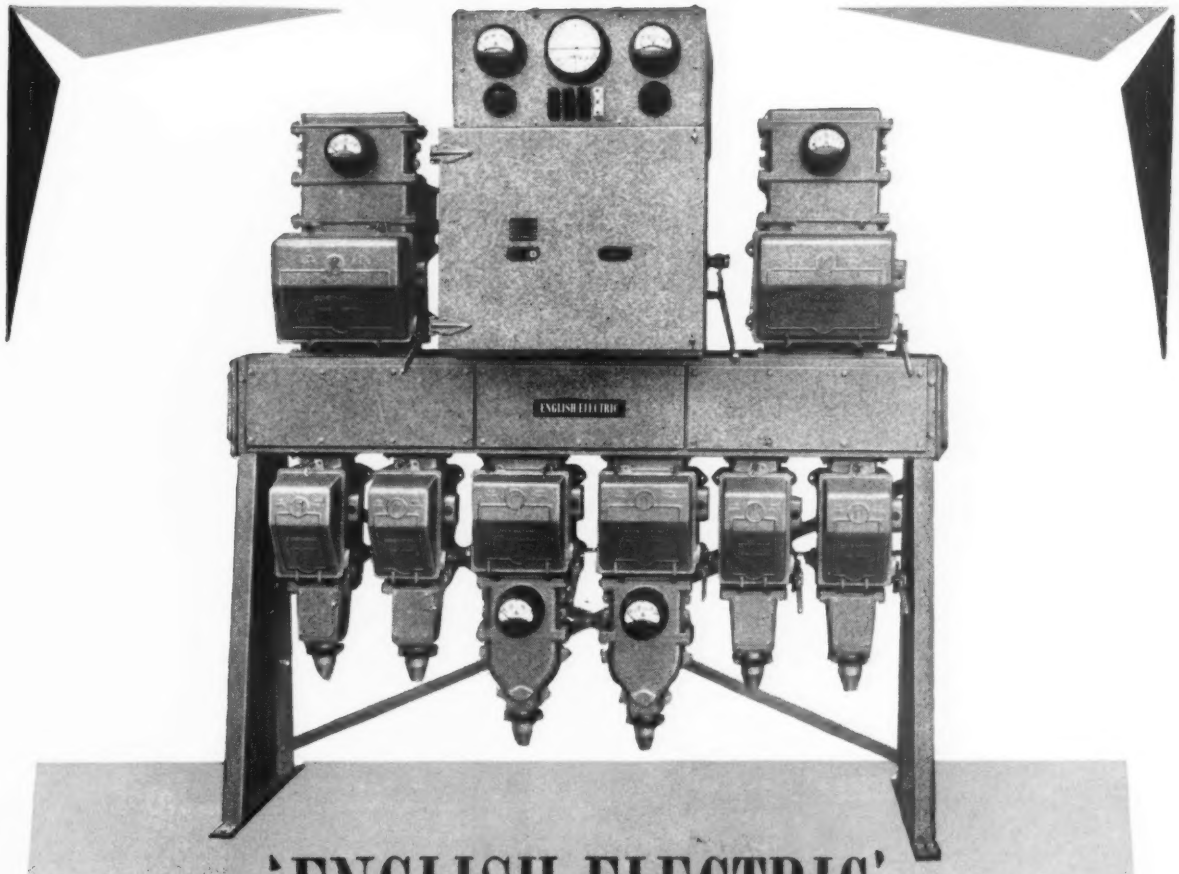

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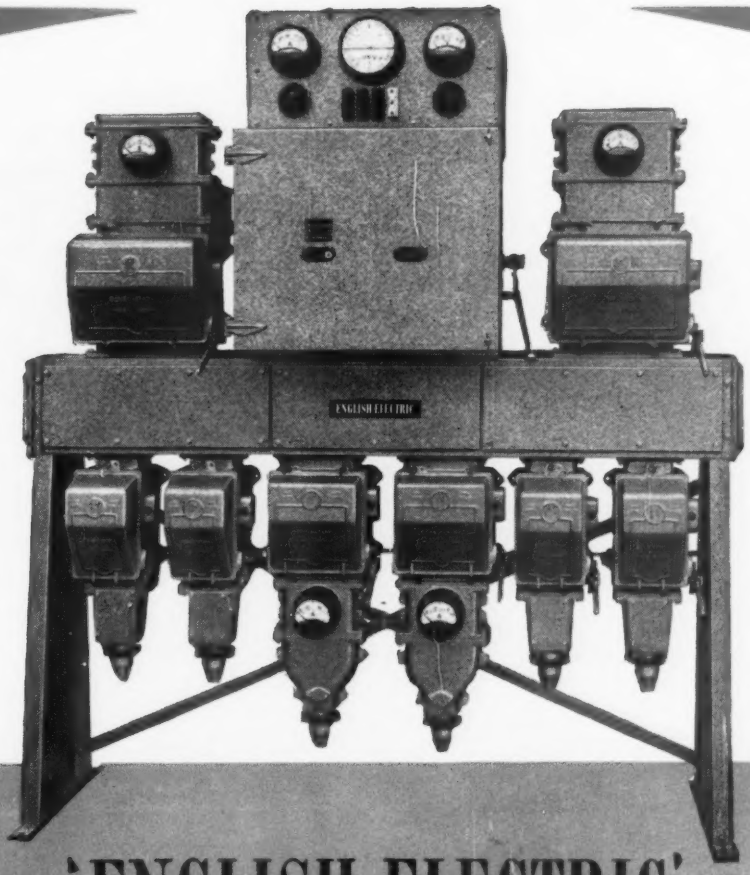

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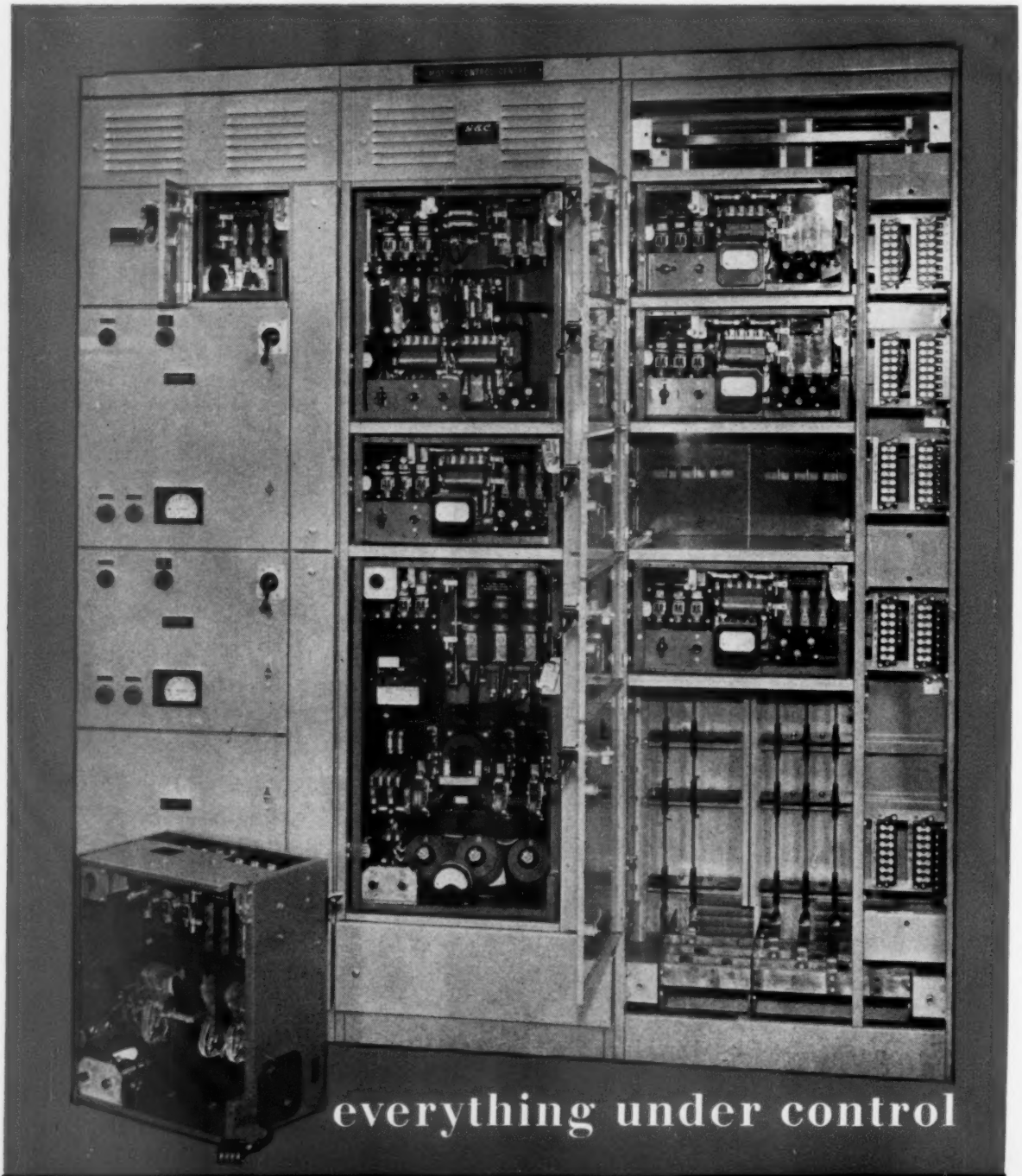

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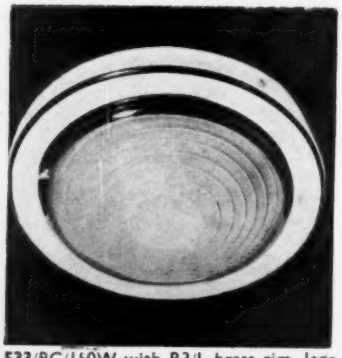

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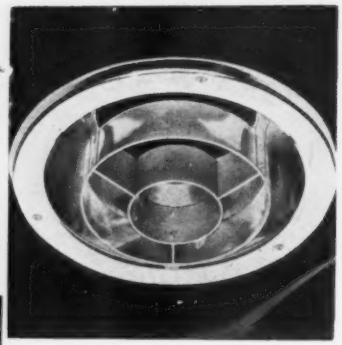
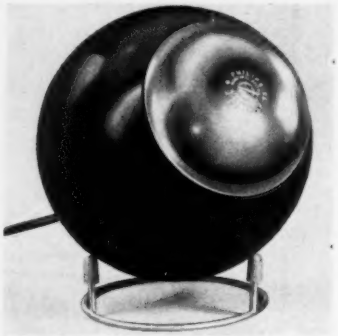


565/BC—mirror finish with Louvre. 32/8



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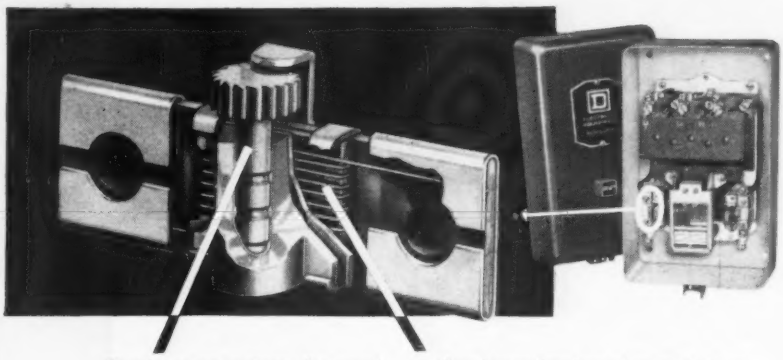

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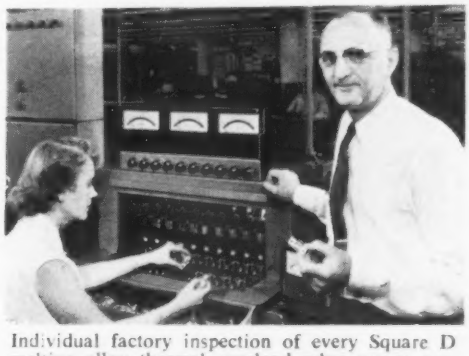

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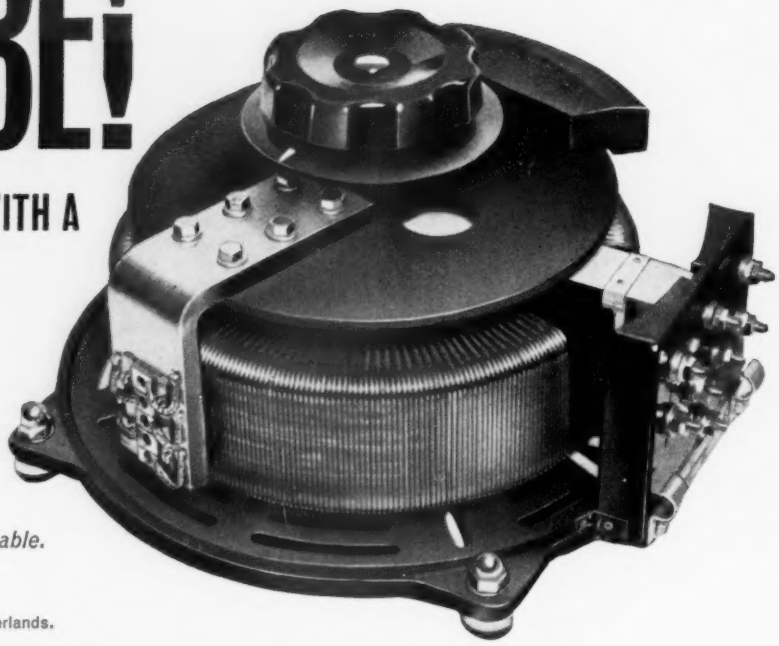

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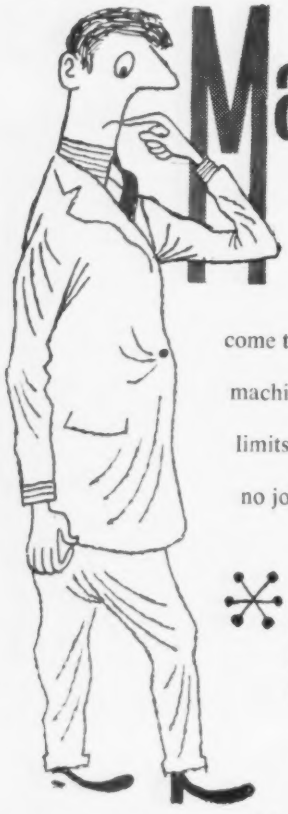

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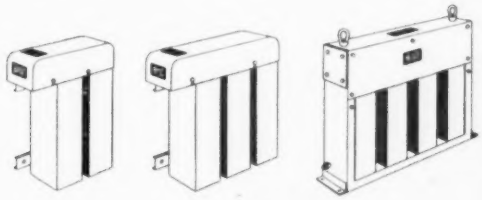

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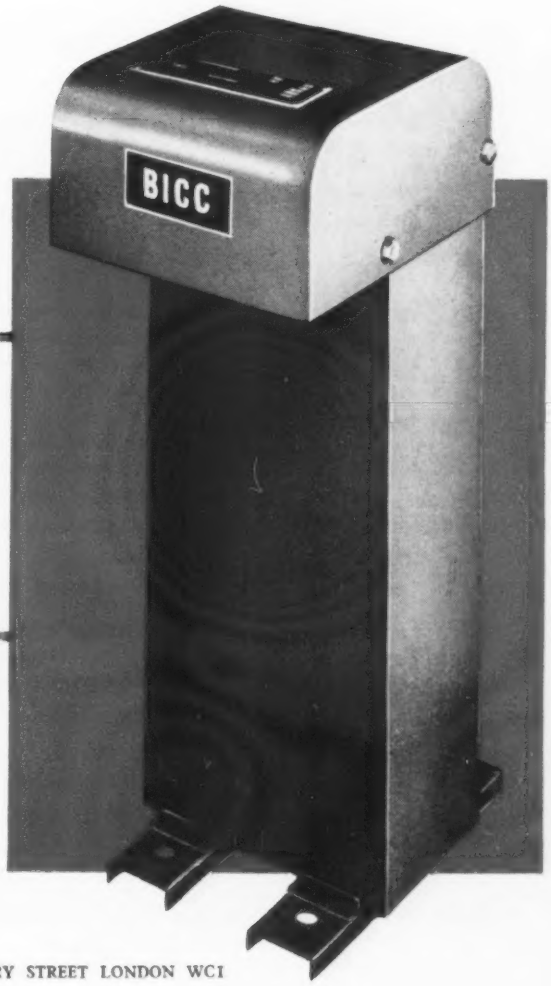

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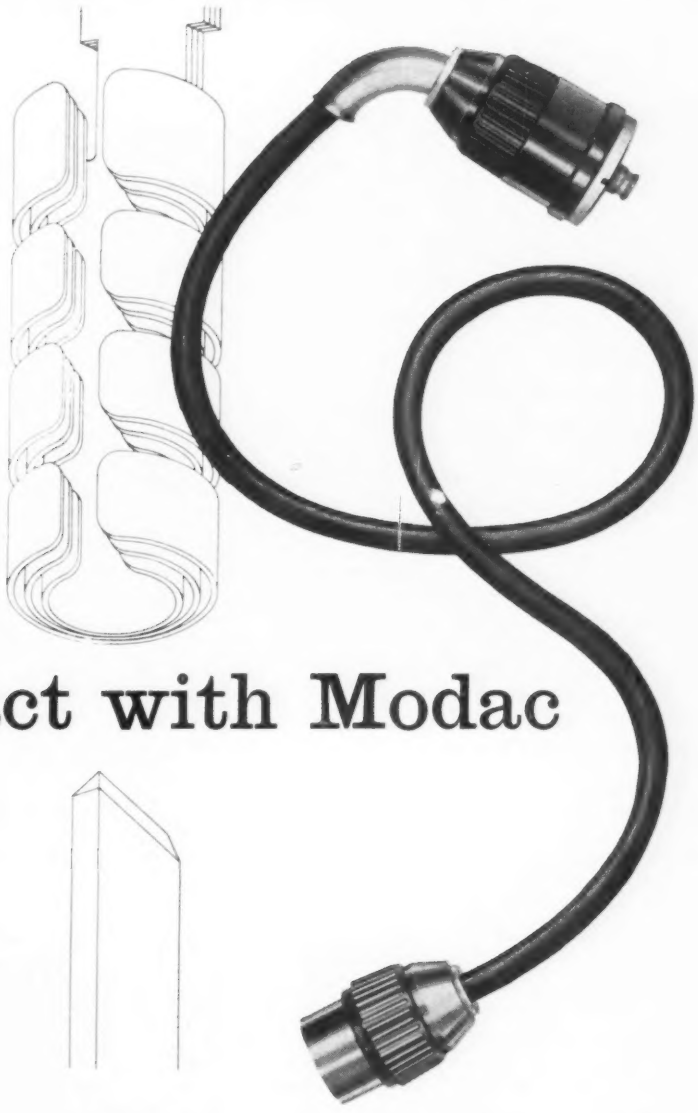

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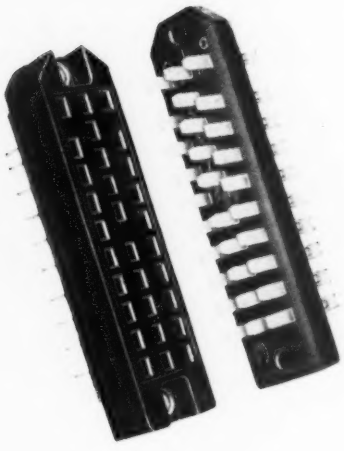

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Front operating switch handles improve appearance and permit more compact assemblies on switchboard and panels.

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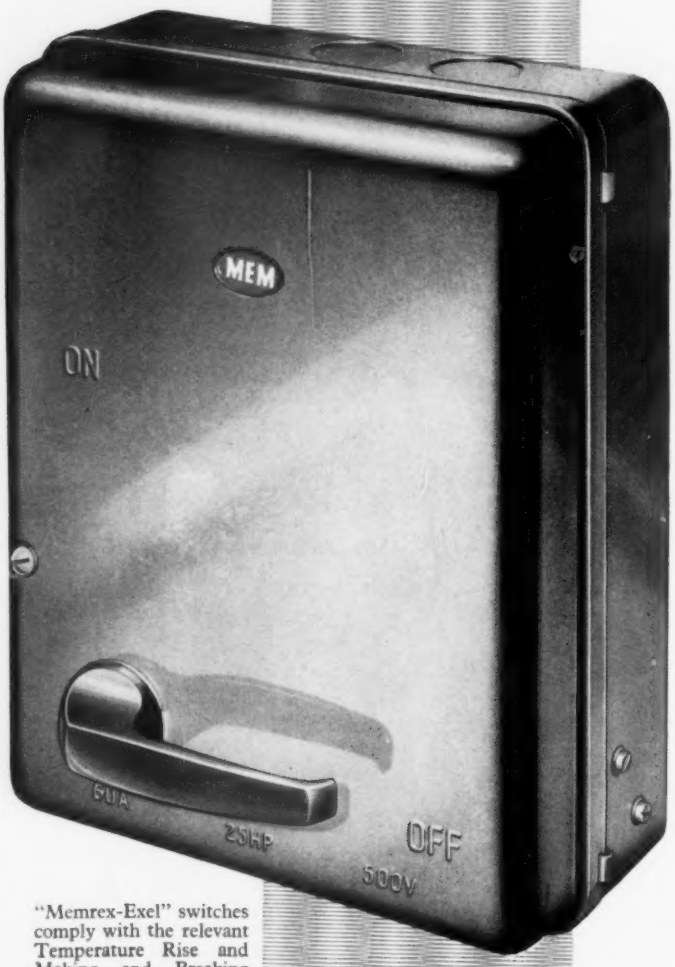
M.E.M. H.R.C. cartridge fuse carriers are designed to accommodate H.R.C. cartridge fuse-links made to B.S.88 : 1952, Appendix 'J' Dimensions, Form A—Offset Tags.

M.E.M. H.R.C. cartridge fuse-links are available for use with this range of switchgear. All ratings have been A.S.T.A. certified for Categories of Duty 440 A.C.3 (16,500 amps), 440 A.C.4 (33,000 amps.) and 440 A.C.5 (46,000 amps.).



"Memrex-Exel" switches comply with the relevant Temperature Rise and Making and Breaking Capacity Tests of B.S.861: 1955 and B.S.2510: 1954.

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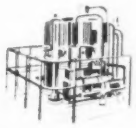
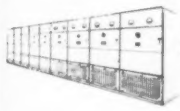


steel-tank mercury-arc rectifier designed and built in Great Britain.
1,500 *kW.*, 615 *v.*



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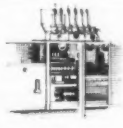

high-voltage steel-tank mercury-arc rectifier designed and built in Great Britain.
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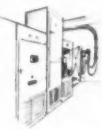

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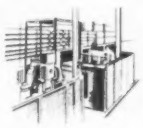

British-built mercury-arc rectifier/inverters.
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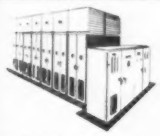

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British-built pumpless steel-tank rectifiers supplying a complete aluminium smelting line.
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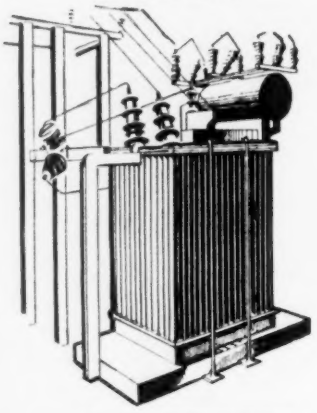

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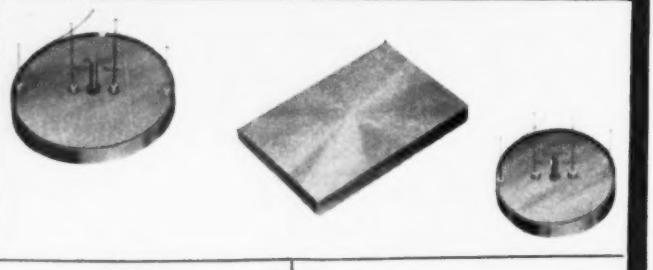

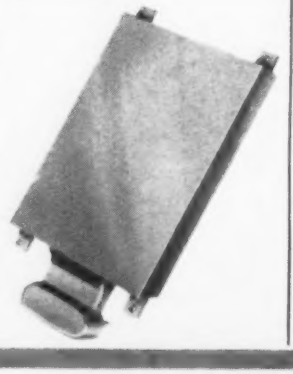

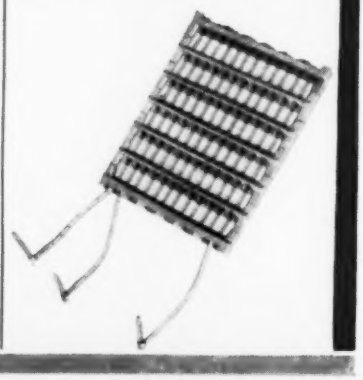

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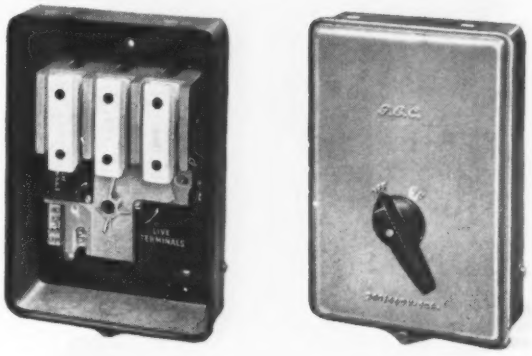

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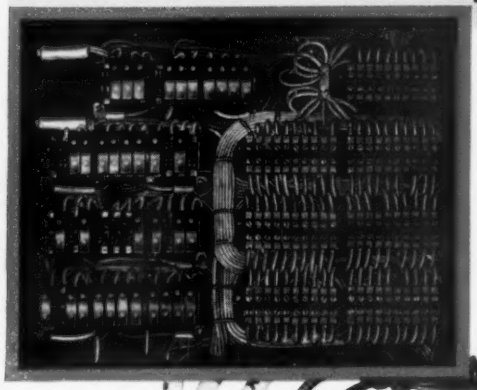

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CW 11

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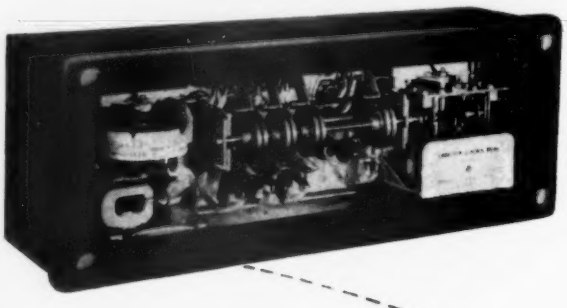
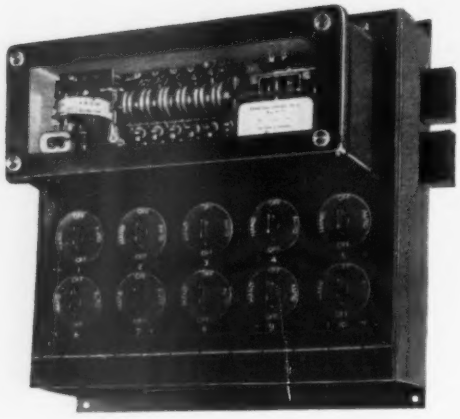
Type NJO4 relay for the control of single-step power capacitors.

A complete range of AEI relays is available for the control of capacitors as a means of improving the power-factor of industrial loads. Please write for full details.





Type NJO3 relay for the control of a number of capacitors or capacitor sections in sequence. It may be switchboard or wall-mounting pattern with or without control switches.

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THURSDAY 18 FEBRUARY, 1960
Registered as a Newspaper Volume 137 No. 7

Dans ce numéro

Amélioration du rendement de systèmes de distribution 239

Des mesures prises par un organisme de distribution dans le sud-est de l'Angleterre, dans le but d'améliorer la sécurité d'opération de son système de 33 kV, comprennent: l'utilisation de c.p.v. sur les conducteurs de lignes aériennes où des oiseaux de grande taille ont occasionné des pannes; l'installation de parafoudres aux extrémités des câbles d'alimentation, du côté des transformateurs et aux points de branchement des lignes aériennes et des canalisation souterraines; ainsi que l'emploi de disjoncteurs en dérivation pour dissiper les pannes de transition. Les détails de projets de systèmes de 11 kV et 6,6 kV sont également donnés. Ils comprennent l'emploi de disjoncteurs à ré-enclanchement automatique, un matériel spécial pour faciliter la coupe d'arbres pour dégager les lignes, ainsi que l'unification de la taille des fusibles.

Système de distribution conçu au moyen d'un calculateur digital 243

On estime que l'emploi d'un calculateur digital pour la conception de systèmes de distribution pour alimenter un lotissement de maisons d'habitation, peut faire réaliser des économies de 6 à 15% des frais d'installation des lignes principales, comparé aux moyens classiques d'établissement de plans. Le calculateur choisit l'emplacement des sous-stations en fonction de la distribution de la charge dans le lotissement, puis calcula, par des moyens itératifs, les meilleures voies pour les canalisations et les dimensions de celles-ci.

Energie et commande dans le traitement du caoutchouc 251

Des commandes électriques pour les calandres de 150 CV. employés pour revêtir de caoutchouc la toile utilisée dans le fabrication de pneumatiques et de tuyaux, sont contrôlées par des amplificateurs magnétiques. Une gamme de vitesses de six à un est obtenue, jusqu'à une vitesse de la toile de 55 mètres/seconde.

In dieser Nummer

Leistungsverbesserungen an Verteilungsnetzen ... 239

In Südostengland hat eine Stromversorgungs-Verwaltung Massnahmen zur Erhöhung der Betriebssicherheit eines 33-kV Verteilungsnetzes ergriffen, darunter die Verwendung eines Kunststoffüberzugs bei Freileitungen, an denen grössere Vögel Störungen verursacht haben, sowie das Einbauen von Stromstoss-Ablenkern an den transformatorseitigen Enden von Speisekabeln und an den Verbindungen zwischen Freileitungen und im Boden verlegten Kabeln und schliess ich die Verwendung nebengeschlossener Abschalter zur Behebung vorübergehender Störungen. Technische Neuerungen im Bauplan eines 11-kV sowie eines 6,6-kV Verteilungs-Netzes werden ebenfalls bekanngegeben, darunter der Einbau automatisch schliessender Abschaltgeräte, die Verwendung besonderer Vorrichtungen zur Erlaichterung von Trassenräumarbeitun und die Normierung der angewandten Sicherungsgrössen.

Digitalrechner im Dienste der Planung von Verteilungssystemen 243

Das Einsetzen eines Digitalrechners bei den rechnerischen Vorarbeiten zur Planung eines Verteilungsnetzes, das der Versorgung einer Wohnsiedlung mit elektrischem Strom dient kann schätzungsweise eine Einsparung der Hauptleitungskosten um 6 bis 15% ermöglichen. Der Rechner ermittelt die günstigte örtliche Lage für die Unterwerke auf Grund der Belastungsverteilung innerhalb der Siedlung und arbeitet sodann die optimalen Linientrassen und Kabelgrössen aus.

Kraft- und Leistungssteuerung in der Gummiverarbeitung 251

Elektrische Antriebe für 150-PS Kalander, die Textilstoffbahnen für Zwecke der Luftreifen- und Gummischlaucherzeugung überziehen, werden mittels magnetischer Verstärker gesteuert. Bei einer im Bereich 6 : 1 veränderlichen Drehzahl, ergibt sich eine Stoffbahn-Höchstgeschwindigkeit von 55 m/min.

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Improving Performance of Distribution Systems ... 239
by R. W. Langley, M.I.E.E.

Exporting Motors to America 242

Computer Cuts Cable Costs 243

Instruction in Holger-Nielsen 245

Contractors and Trading 246

Experts on Exports 249

INDUSTRIAL ELECTRICITY

Supply and Control in the Processing of Rubber ... 251

Outputs from Variable Speed Motors 255
by F. Brassington, A.M.I.E.E.

Electric Heating for Stress Relief 256

New Electric Smelting Service for Industry 256

E.D.A. Speaks on Housing Standards 257

Eliminating Installation Faults by Instruction—Part 2 263
by E. J. Sutton, M.I.E.E.

Automatic Conveyor for Lamp Bulbs 265

Protection for Watchmen and Premises 268

FEATURES

Progress in Patents 248
Overseas News 258
Personalities in the Industry 260
New Literature 262
For the Electrical Trade 266
Equipment for Industry 267
News of the Week 269
Company Activities 274
Commercial Information 275

News Sheet 21
Classified Advertisements 45
Index to Advertisers 52

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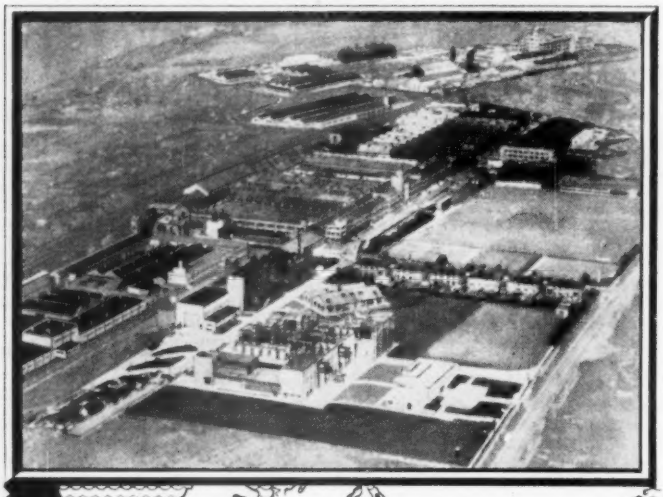
SWITCHGEAR



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Comment

HOW LARGE IS A.D.M.D.

For the design of distribution systems to supply new housing estates, 3 kW after-diversity maximum demand has been for some time the accepted figure. Indeed, that figure has been the aiming point of the more forward looking supply engineers; something less has seemed sufficient for many networks. Now new developments in domestic use of electricity are causing some feverish re-thinking of this figure. At last week's IEE meeting on computers in distribution system design, some contributors to the discussion were making clear their concern that a much higher figure will need to be taken for substation and mains planning in some circumstances in the future. Actual after-diversity maximum demands as high as 15 kW have been experienced for some estates, a major jump from 3 kW. The increase is largely caused by extended use of off-peak electric floor-warming in some areas, and the growth in the amount of power being built into cookers. Dark stories are being heard from mains engineers in suburbs of large cities, about the magnitude of individual loads between 7 and 7.30 p.m. as floor-warming switches on, hot water begins to be used, and the family's dinner is cooking in the electric cooker. Here is clearly an urgent need for new figures from the industry's research activities, co-ordinated by the Electricity Council. The 3 kW a.d.m.d. apparently had its origin in ERA tests carried out in the early post-war years; some revision is certainly needed. Although an increase of the magnitude that the discussion implies can come only from virtual loss of diversity, on small estates this may easily occur. If it has to be faced on any extended scale, it will raise a conflict of interest between local distribution considerations and the national generation and transmission desire for a better overall load factor.

QUALITY IS NOT EVERYTHING

The traditional boast of British industry about the quality of its products came in for some blunt criticism at last week's BEAMA domestic appliances export sales conference. A Swedish contributor in a feet-on-the-ground paper argued for the deacon's shay approach: "the clever thing to do is to make an appliance just good enough for the purpose required and no better." If it is better, the argument runs, the customer is being asked to pay for more than he needs. On its own, this is a debatable thesis, for there is an element of statistical chance in the breakdown and failure of mass produced equipment, and "just good enough" can never be an absolute measure. However, that consideration is largely overtaken on some parts of the Continent by activities of official test houses and unofficial

ELECTRIC FLOOR-WARMING

Next week's issue will include a number of articles on electric floor-warming, reviewing experience with installations and surveying some of the investigational work now proceeding. There will also be a reference list of commercially available floor-warming systems and control equipment.

but influential consumers' societies. Once equipment is good enough to attract endorsement by such organisations any added quality becomes a price-increasing factor which is unlikely to carry sufficient selling pull to offset that disadvantage. Nor is long-life an unalloyed advantage. With fashion and its vagaries running strongly in domestic equipment design as regards exterior styling, appearance may set a term to useful life as definite as performance. Styling is one of the factors in design in which Britain has been lagging behind Continental and North American manufacturers; another that may be equally serious is in the conception of new specialised types of appliance. If the Swedish paper combines with others read to the conference, to influence British manufacturers to attach more importance to these points, the commendable initiative of the young Domestic Appliances Division of BEAMA will indeed have been crowned with success.

NO ANSWER TO SULPHUR

Thirty years of research, experiment and field testing have left unsolved the practical problems of removal of sulphur oxides from flue gases. Many solutions have been proposed and some have passed beyond the laboratory stage, but all have failed against the severe limits imposed by commercial operation. There is little optimism to be found in the DSIR report published last week on fuel research in 1958. The dry processes from which so much was hoped have been abandoned and the wet techniques suffer from the general trend that the higher the efficiency of absorption, the lower the efficiency of sulphur recovery. Only with the Simon-Carves ammonia process is success reported at the large CEGB pilot plant, but its extension is limited by availability of supplies of ammonia liquor. Work is continuing, however, in the hope of finding a cheap process of wider applicability. If but little can be done towards the removal of sulphur oxides, more has been learned of the nature of their dispersal. Study over several years of conditions surrounding Staythorpe, have produced a pattern which agrees generally with the theoretical treatment of dispersal of chimney gases. Thus, although the emission of sulphur cannot be avoided, at least there is a surer basis to any forecast of the extent of concentrations that are likely to arise.

ELECTRICAL INSPECTION FOR OFFICES

There have been many Parliamentary attempts to implement the main recommendations of the 1949 Gowers Committee report, which suggested a kind of Factories Act for office workers. The latest Private Member's Bill on the subject received a second reading a short while ago, albeit against Government wishes, and now there are indications that it may make further progress. There is importance here for the electrical industry, as the Bill seeks to impose through regulations, a standard of temperature and of adequate ventilation for offices; sufficient and suitable lighting; and regular inspection and maintenance of electrical equipment. So great is the gap between conditions in the best appointed offices and the average, that if these ideas do pass into law, a great opportunity will present itself to contractors and manufacturers. The particular suitability of electricity for bringing improvements to existing buildings would need to be exploited to the full if some offices were to be brought up to any reasonable standard; and no doubt the regular inspection of electrical equipment would encourage sizeable re-equipment rather than the cost of a large running maintenance bill. Progress of the present measure will be watched closely, for some commentators have suggested the Government will indicate a willingness to accept in principle the idea that statutory regulations along these lines should be made. However, it seems likely that even if this comes about, application of the new standards will be slow, for a large inspectorate would be needed to enforce them.

DISTRIBUTION DETAILS

Much can be done to improve operation of a distribution system through step-by-step examination of all the many-time-repeated techniques that go to make the whole. That is one of the common functions of engineering management; what it has resulted in for the South Eastern Electricity Board is told in an article we publish this week. Much of the story is that of standardisation of good practice, though some enterprising willingness to experiment is apparent in such projects as the use of shunt-connected circuit-breakers for protection against transient faults. Again, others of the standardised practices have application particularly to the circumstances of a particular area. Of broader application may be the conclusions of the Board on the subject of tree lopping to preserve clearances on overhead lines. This operation has been tackled in a comprehensive manner, with specialised equipment such as an hydraulically operated mobile elevator to speed the work. The pay-off is seen in a reduction in the number of faults; indeed, it is thought that tree-cutting on the scale practised may itself provide such a precaution against transient faults that a move to techniques such as arc suppression coil earthing may be rendered unattractive where they would previously have been a worthwhile precaution.

Meteor

This week's quick summary of electrical news faces advertisement page 20.

Improving performance of distribution systems

by R. W. Langley,* M.I.E.E.

AS part of the responsibilities of Area Boards, laid down in Section 1(6) of the 1947 Act, the South Eastern Electricity Board, in common with most other electricity boards, have been engaged on an extensive programme of expansion of their distribution systems, particularly in rural areas. Section 1(6) of the 1947 Act charges the Area Electricity Boards to "secure, so far as practicable, the development, extension to rural areas and cheapening of supplies of electricity." To give some idea of the progress that has been made in meeting this requirement: in 1948 there were 5,700 odd farms on supply in the South Eastern EB area and this, by the end of 1959, had risen to over 11,000. To achieve this, many hundreds of miles of line have been erected and a large number of transformers of varying sizes installed.

Such expansion brings with it problems of maintenance both of supply continuity and also of the lines and equipment installed. These two factors are to some degree complementary, since the more transformers and equipment that are installed and the longer the lines become, the more difficult it is to maintain reliability of the supply given and the number of failures tends to increase in proportion.

Attention has been focused on the causes of faults so that by correct design, construction and operation the number and duration of supply failures can be reduced to a minimum. By the steady improvement in techniques the aim has been to provide a supply in these rural areas which is comparable in reliability with those given in the towns.

The solution to this problem has a two-fold benefit; the consumer can be given a more reliable supply and the cost of operation and maintenance is reduced since staff are no longer required for unnecessary repair work and restoration duties following a fault. This article deals with some of the measures which are being taken by the South Eastern Board to improve rural distribution performance on systems up to 33 kV.

33 kV Systems

These are planned as far as possible on the basis of transformer-feeders fed from a 132/33 kV grid substation. The 33 kV line construction is of BS 1320 type, using wood poles and pin-type insulators of BS 90 rating, except at section points where three or four 10 in. cap-and-pin insulators are employed. Care is taken to avoid introducing, along the line, any support having a low impulse level, since this has been found to cause trouble unless special precautions are taken. In areas frequented by swans or other large birds, p.v.c.-insulated conductors are sometimes used on the centre phase to prevent failures from conductor clashing. The thickness of the p.v.c. is 60 mil and has been most effective; no signs of deterioration have as yet been detected in the insulating qualities.

The high impulse level of the line makes it necessary to provide adequate over-voltage protection at both ends to prevent damage to terminal equipment. At the transformer end, surge diverters are installed and these are placed as close to the transformer terminals as possible, usually 4-5 ft away; the earth terminals being bonded direct to the transformer tank. The standard 2 by 3¼ in. duplex gaps are retained on the transformer bushings as an additional safeguard should the surge diverter fail to operate.

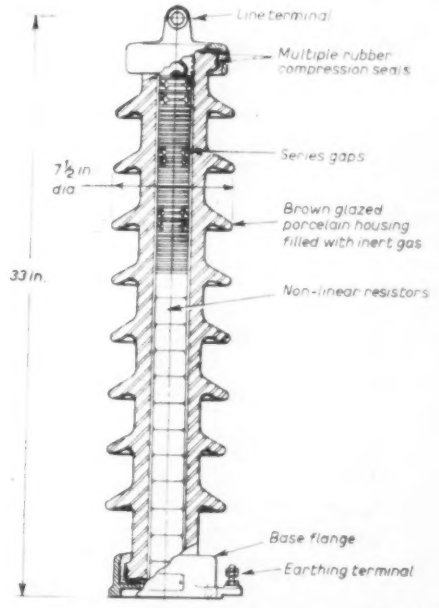


Fig. 1. Sectional view of the type of surge diverter used by the SEEB on 33 kV systems

At the sending end it is usually difficult to avoid cable from the switchgear to the line, since in many cases space limitations prevent outdoor switchgear being used, quite apart from difficulties of routing. Surge diverters are therefore installed on the terminal pole at the junction of the line and cable. The conditions at the sending end are far less onerous than those at the receiving end, since voltage doubling cannot occur if all switches are closed. In addition, the cables and switchgear have an impulse level equal to or greater than a transformer, consequently adequate protection is provided by surge diverters. 10 in. single gaps are also provided in most cases on the tension sets at the termination as a back-up. Short sections of cable which are unavoidable throughout the length of the line are dealt with in a similar way.

* Mr Langley is with the South Eastern EB.

Surge counters are normally provided with the diverters at the transformer end of the line, and if surge counts can be taken as a criterion, many supply failures have been avoided by the operation of the diverters.

The type of surge diverter used is shown in Fig. 1; it has an impulse breakdown value of approximately 120 kV with a maximum residual voltage at 20 kA of 145 kV. As will be seen, the diverter consists of a number of specially designed spark gaps in series with a stack of non-linear resistors. This assembly is housed in a porcelain container with outer weather sheds, the container being sealed to prevent ingress of moisture. As an added precaution against internal deterioration, the air is extracted and replaced by dry nitrogen.

Before adopting the policy of using surge diverters, consideration was given to the types and sizes which would be appropriate and the "line type"—in preference to the "station type," suitable for systems where the neutral is earthed via a resistor—was finally selected. Their reliability and effectiveness have been quite satisfactory so far, the number of failures being extremely low (less than 1%), and no change is at present contemplated.

To cater for faults which are not cleared by surge diverters, high-speed overcurrent and earth-fault protection is provided at the sending end with the standard restricted earth-fault, Buchholz, and directional overcurrent protection at the transformer end; a fault thrower is used to trip the sending end should a fault occur on the transformer or its associated equipment.

High-speed fault clearance has been found most effective in preventing an otherwise transient fault developing into a persistent fault, and also in preventing excessive disturbance to the remainder of the system. This feature is important, particularly when there are consumers with motors driving continuous process machines. High set instantaneous overcurrent and back-up IDMTL relays are used, together with sensitive earth-fault relays. The speed of fault clearance with such an arrangement is between 7 and 10 cycles, and it has been found that if this is materially increased, damage requiring repairs is much more likely, and the disturbance to the remainder of the system is much greater.

On this basis, if an insulator flashes over or conductors clash, the fault is of a transient nature, and the circuit can be re-energised without repairs being necessary. Automatic reclosing of the o.c.b. is therefore provided at both the sending and receiving ends. A single-reclose non-repeat feature is now employed with a two-minute dead time between fault clearance and reclose—an arrangement which has proved very satisfactory.

To improve still further the continuity of supply and to reduce the dead time to a few cycles, another scheme is to be tried and is now in the final stages of development prior to installation. This is the use of shunt circuit-breakers which will be installed on the busbars of a grid substation. Three breakers will be used, one between each phase and earth, and the control will be such that if an earth fault occurs on any outgoing line the affected phase will be short-circuited to earth through the closing of its associated breaker. When the shunt breaker closes the voltage at the point of fault collapses and is thus insufficient to sustain the arc; the shunt breaker then opens and the system is restored to normal. Such a scheme has been used on the Continent with success, and it is hoped may be useful on 33 kV systems in this country. For such an arrangement the neutral must be earthed through a resistor to limit the current to a comparatively low order, i.e., 1 to 2 thousand amps.

With automatic reclosing schemes, particularly if there is only one reclose which is not repeated, some form of alarm is employed to ensure that the breakers receive attention. There are a number of different systems being used, from v.h.f. radio to direct-wire private telephone.

No standard form of alarm system has yet been adopted and, since there is a number to choose from, each having its own advantages and disadvantages, the principle has been to apply the scheme most appropriate to the particular installation. General alarms have been found sufficient, since any abnormality, from a switch tripping to a delayed tap change, requires a visit by an engineer.

To facilitate line switching at 33 kV, air-break switches with interrupter heads are now used extensively. Some trouble was experienced in the early days due to moisture affecting the internal mechanism, but this has now been overcome. A typical installation showing a transformer protected by surge diverters and controlled by air-break switches with interrupter heads is shown in Fig. 2.

11 and 6·6 kV Systems

The techniques adopted on lines at these voltages have been similar in some respects to those at 33 kV, but, due to the greater line mileage and multiplicity of tapping points for transformers, additional measures have been necessary, the most important being :

1. Improved tree-cutting techniques.
2. The fitting of auto-reclosers.
3. The use of repeater fuses.
4. The conversion of overhead lines from earthed to unearthed construction.
5. The reduction in the number of fuses to an absolute minimum.
6. The fitting of over-voltage protection in the form of duplex gaps or surge diverters.
7. The use of arc suppression coils.

Tree-cutting

With the increased mileage of overhead lines the problem of tree-cutting has become more acute and, if staff and transport are not to be materially increased, measures must be taken to improve techniques. This problem has been tackled in a number of ways, but the most significant is the use of a special mobile elevator, hydraulically operated by the man aloft who can manoeuvre his bucket-type platform as he wishes. He is thus able to negotiate difficult situations and carry out the tree-cutting more quickly and more efficiently. A picture of such a hoist mounted on a lorry is shown in Fig. 3—a smaller version on a Land-Rover is also used.

Auto-reclosers and Reclosing Circuit-breakers

With properly designed and maintained systems it has been shown that 90% of the faults are of a transient nature, provided they can be cleared rapidly, and various types of pole-mounted auto-reclose switches are being used. The high-speed recloser pioneered by the Midlands Electricity Board has been particularly successful where the fault level has been below 50 MVA, but co-ordination of protection on both sides is an important feature of successful performance and considerable care was found to be necessary at the planning stage.

Many of the older types of pole-mounted auto-reclose circuit-breakers are still in use and have given good service—their modern counterparts are now coming into operation as a more economical alternative to the recloser.

Live-line Working

To obtain the full benefit from reclosers and reclosing circuit-breakers, air-break switches on each side are avoided whenever possible and live-line working is adopted. This practice has the advantage that pole-mounted reclosers and transformers can be installed or removed without shutting down the supply, except perhaps to a few consumers. The method developed by the Midlands Board has found most favour and is now being used to a limited degree. It has not been easy to get enthusiasm, however, either from the engineers or the linesmen in adopting the principle.

Repeater Fuses

In cases where the use of auto-reclosers cannot be justified on economic grounds, repeater fuses are sometimes used. Care is necessary, however, to prevent maloperation by providing adequate clearance. In addition, it has been found that lines longer than a mile or so, particularly in exposed positions, are sometimes affected more than once in a lightning storm and continuity of supply cannot be maintained. Single and double repeat fuses are now being tried with some degree of success. The design of the tripping mechanism has given trouble, but this is now being rectified and should improve the reliability.

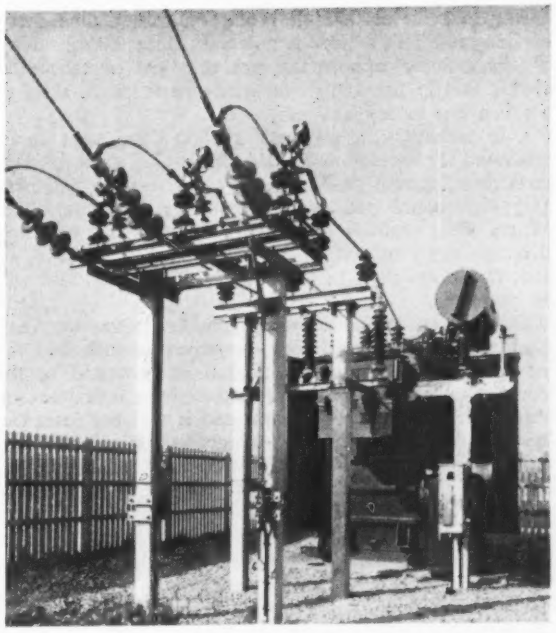


Fig. 2. Typical arrangement of transformer protected by surge diverters and controlled by air-break isolators fitted with interrupter heads. On the right can be seen the fault-throwing switch

Line Conversion

The success of lines constructed to BS 1320 in preventing failures due to birds, squirrels, flying twigs and straw, etc., has led to a widespread conversion of some of the older lines which had under-running earth wires or each pole earthed. Agreement was reached with the Ministry of Power to remove the earth conductors, provide insulated stays and generally to convert to BS 1320 type. This has resulted in some improvement, but care was necessary to ensure that all transformers and cables, together with other terminal equipment, were adequately protected by duplex gaps or surge diverters against damage due to over-voltages caused by lightning. In most instances it was not found necessary to renew the insulators except at road crossings.

Fuses and Line Isolators

Some years ago a survey was made of the types, sizes and circumstances in which fuses were installed, and it was found that in total 42 different sizes were in use; transformers were, in general, individually fused and no attempt was made to provide co-ordination between h.v. and l.v. fuses.

Four sizes of fuse are now used—7·5, 15, 30 and 50 amp—and group fusing is adopted where possible. Many of the older systems still have the transformers individually fused, but it is hoped that in time these will be changed to provide group fusing. Slow-blowing fuses are used when required to operate in conjunction with reclosers.

As an experiment, some sections of the network are being operated without h.v. fuses, protection being provided by high-speed reclosers, together with back-up breakers

Fig. 3. Simon hydraulic elevator mounted on truck in use for tree-cutting operation. The man aloft can control the position of the platform

having sensitive earth fault protection with a time delay of 5-10 secs. This feature is necessary since the sensitivity of the recloser is normally not sufficient to cause the switch to trip for a high resistance earth fault, such as a fallen line in dry weather.

Line isolators or air-break switches are kept to a minimum since they introduced points of low impulse level and frequent flashover will occur, causing unnecessary disturbance and probable damage if uncontrolled. Where these switches are installed duplex gaps or surge diverters are provided on each incoming termination, so that if the switch is in the open position both sides will be protected.

On some of the older systems pole-operated fuses have been replaced by solid links—a scheme which has the advantage that the impulse level is not changed by the conversion but the facility for sectionalising is maintained. A further advantage of this method is that the fuses can be replaced if required in emergencies, when an intermittent fault occurs. With this type of line isolator, rod gaps or surge diverters are not required, since there is no connection to earth at this point.

Over-voltage Protection

When lines are converted to unearthed construction it is essential to ensure adequate protection for terminal equipment against damage due to over-voltages caused by lightning. Suitable gaps, mostly duplex to avoid bird troubles, have been developed for pole boxes, strain, and post-type insulators. Flashover, when it does occur, is thus controlled, and damage is prevented both to the insulator itself and the equipment on which it is fitted. In some cases gaps are not satisfactory due to their relatively slow speed of operation and surge diverters are necessary. Such conditions occur where switchgear having a low impulse breakdown voltage is connected to the line through a short length of cable. The extensive use of surge diverters at these voltages has not been considered a justifiable expense, reliance for rapid restoration of supply being placed on auto-reclosers and repeater fuses.

Arc Suppression Coils

In general, the Board have not used arc suppression coils to any great degree—a number are in use, however, and they have proved quite successful. A survey is now being made to see whether a more extensive use of such devices would be worth while. Preliminary results suggest that, with lines constructed in accordance with BS 1320, provided tree-cutting is maintained, the advantages would be marginal.

Underground Cable Systems

For some years now the tendency has been to reduce the amount of automatic switchgear to a minimum and fault-making oil switches are used extensively. Small distribution substations are provided with a ring main unit having a fused tee off, and fault making switches on each side. With protection h.v./l.v. discrimination has been possible by the correct selection of fuses and it is now very rare for an h.v. fuse to operate for an l.v. fault. Those few instances which do occur are found to be due to faulty h.v. fuses.

As the next best thing to automatic protection, some form of indication is helpful. In Seeboard earth fault indicators are now used and have proved useful in reducing the time taken to locate a faulty section and restore supplies to normal.

Main supply stations stepping down the voltage from 33 kV are now fully automatic and need no attendants—alarms to a sub-area control centre give indication of any abnormality and have proved a worth-while saving.

The author wishes to express his thanks to Seeboard and in particular to Mr W. E. Gibbs, M.I.E.E., Engineer-in-Chief, for permission to publish the information in this article.

Exporting motors to America

INTEGRAL-HORSE-POWER electric motors manufactured in the UK can be sold in the USA at prices competitive with the home product. That is the lesson of experience stated in a market report on selling electric motors in the USA, prepared by the commercial department of the British Embassy, Washington, and published by the Board of Trade. It is thought that it may be more difficult to offer fractional horse-power motors at attractive prices.

Market Size

Size of the US market for motors is shown by the value of home production, over $1,600 million in 1958, compared with only $3·5 million for imports. The activities of the home manufacturers demand intensive effort if effective competition is to be established, and the advice given is to set up a subsidiary company in the USA if trade on any scale is contemplated. Import duties to be met are 10½% *ad valorem* on motors of more than one-tenth h.p. and less than 200 h.p., and 12½% on other motors.

It is natural to find the market report stressing the importance of complying with US standards in any motors offered, in this case NEMA standards. However, some glosses are added to this advice, more specifically concerned with US practice. For instance, because much original equipment is sold without motors, attention must be given to prevailing dimensional standardisation of mechanical features, so that standard mountings are matched. Again, where motors may be used in domestic equipment, approval of Underwriters' Laboratories Inc. is advisable, as in many States such approval is a necessary precondition to the sale of domestic equipment. There are local technical and appearance preferences to meet as well. The survey notes that motors should be finished grey and that roller bearings may prove unacceptable in applications where they would be used in Europe. To facilitate servicing and fitting, American wire sizes should be used, and, of course, US threads.

The leading US suppliers have a sales staff specifically concerned with development of sales to original equipment manufacturers, and they also have their own wholesale supply house with branches in many cities. In addition, they sell to independent supply houses. Most manufacturers are represented by their own sales staff or by agents having an exclusive franchise for a given territory, and receiving commission on all business in that territory. Standard commission is 10% basic, though this may vary with the type of business done. Representatives have a fair standard of technical knowledge, so that they can discuss engineering applications of the motors they sell. They commonly handle associated equipment such as starters, speed control gear, etc. Some supply houses act solely as spare parts distributors, having an exclusive arrangement for a given area.

An important feature of US selling is the mail order house. These are particularly important for f.h.p. motors and for farms. Products may be brought from them on the basis of their reputation, which offers a way of overcoming antipathy to imported equipment.

Computer cuts cable costs

ECONOMIES IN HOUSING-ESTATE DISTRIBUTION

FOR the systems design engineer, the future would seem to hold bright prospects of less tedious calculation, although it will require a knowledge of computer programming techniques if the portent of two papers read before the IEE* last week is realised.

Mr Knight's paper, referred to later, described a linear programming technique for designing networks interconnecting substations to obtain one of minimum cost. The technique promises to be a valuable reinforcement to the use of analogue and digital computers as methods of network analysis.

The second paper describes the way in which a digital computer has recently been applied to the problem of planning a complete electrical distribution system for housing estates to find not only the most economical cabling routes and sizes, but also the most appropriate substation sites.

It is only since the war that high costs of copper and plant has focused attention on the possibility of effecting considerable economies in distribution system design. A CEA and area board report published in 1954 recommended radial distributors based on the single main system rather than the interconnected networks previously in wide use. The report also included formulae for estimating numbers of substations required for a given estate loading and recommended cable sizes, which have since been widely adopted by area boards.

Design Techniques

Planning an estate distribution system may be divided broadly into two stages : first, determination of the number of substations required and their positions; and, second, obtaining the actual routes for the cables from substation sites to consumer's premises, and their sizes.

The computer calculates number and position of substations from information fed into it concerning individual after-diversity maximum demands and in accordance with its programme. For convenience, in the calculations described in the paper the estate was subdivided into ¼ acre squares with the load in each square assumed to be concentrated at its centre. This load, and its locating "*x*" and "*y*" co-ordinates were fed into the computer. From this information the computer calculated the number of substations and their theoretically best sitings in accordance with the instruction programme. Number of substations was based on established formulae and their position determined by an iterative process. Principle criteria for preliminary choice of substation position were minimum cost and voltage drop restrictions. At this stage, loads were assumed to be connected to substations by straight lines, that is ignoring road layout. The substation position must ensure that concentrated loads are allocated to the nearest substation, and that it is also the best position within its area of supply.

Having decided on an initial position, the computer moves the substation site through successively more economical sites by an iterative process. With preliminary areas allocated to particular substations, the computer calculates the position of the load centre of gravity for the area first allotted to it, moves the substation to this centre of gravity and then recalculates load centre of gravity for the new area embraced by the new position of the substation. This process is repeated until there is no appreciable movement of the substation site. It requires that initial points should be well separated, and two methods were used to select these.

In the first, the computer selected groups of squares, equal in number to the selected number of substations and proceeded to locate these composite squares on to the estate map, enlarging and adjusting their position until they were just contained in the estate boundaries. The centres of these squares then formed the initial starting points for the iterative process. The alternative method was to work from a point near the estate boundary. The diagram illustrates how the two methods selected, by successive calculations, the final site for one substation on an estate.

The substation positions selected by the computer will not normally be practicable sites since the calculation disregards road and house layout. The designer, therefore,

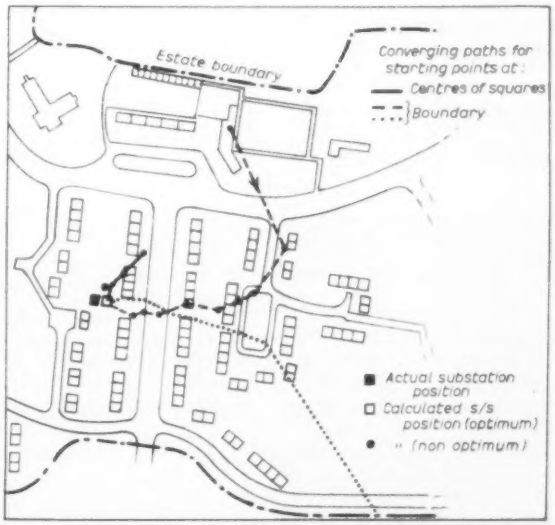


Fig. 1. Development plan for estate number 2 showing one of the substations and the routes taken by the computer during calculation of its final position. The estate had five substations, two coincident with the locations chosen by the designer and the remaining three up to 400 ft distant. The estate covers nearly 100 acres

* Paper S 3138: "The logical design of electrical networks using linear programming methods," by U. G. W. Knight, B.SC.(ENG.), A.M.I.E.E. Paper S 3131: "The design of housing-estate distribution systems using a digital computer," by R. L. Grimsdale, M.SC., PH.D., graduate, and P. H. Sinclare, M.SC., A.M.I.E.E. Mr Knight is with the CEGB, Mr Sinclare with the YEB and Dr Grimsdale is at Manchester University.

selects several usable sites adjacent to the computer calculated sites and feeds information concerning them into the computer, which then selects the final site automatically. It would be possible to programme the computer to move a substation from its initial calculated position to the nearest road and then to find the minimum cost site, but this method still requires manual adjustment and recalculation to obtain accurate costs for the final site.

Cable Routes

When the substation sites have been selected, feeder routes are established by using the computer to allocate road sections to the various substations. This it does from information representing for each road section, the load, number of consumers, and a locating symbol for each road junction. After cable routes have been established, cable sizes are selected first, theoretically, and subsequently from the best practical cable sizes close to the theoretical sizes. After practical sizes have been calculated, interconnector requirements are considered using, as a basis, lowest cost consistent with providing transfer capacity to the extent of one-third of the loading on each substation. Improvements in cable layout can then be attempted; for example, it may be cheaper in some roads, where there is no distributed load, to use a longer feeder route, so avoiding that particular road section.

The final stage in the calculation is to examine the scheme as an entity with substation sites and cable runs included to assess whether further modifications to layout; for example, moving a substation in the direction of its largest outgoing feeder will improve the system. It was found, however, that little final readjustment was necessary to give the optimum design.

Manual v. Automatic

Comparative costs for manual and automatic designs for four estates are given in the table. It should be noted that estates 1 and 2 were model manual designs used to demonstrate the technique of the tapped single mains system. The excess facilities cost shown in the last column was obtained by modifying the automatic design to include the generous interconnectors and substation outlets allowed in the manual design.

Table 1

Estate number	Manual design, M.V. cable and excavation *total* costs	Automatic designs, *Saving* over manual design costs		
		Minimum cost designs		Excess facilities design with actual substation sites
		Actual substation sites	Calculated substation sites	
1	£7,438	£444	£484	£334
2	£11,624	£440	£696	£120
3	£6,939	£144	£458	£144
4	£8,446	£1,200	£1,226	£428

Cost Comparisons between Manual and Automatic Design

The computer always selected the most economic number of outlets, whereas the manual design used criteria of maximum load or number of consumers per outlet. For instance, the computer would tend to select one large cable rather than two smaller ones with the same total cross section.

The savings shown in table 1 have been reduced to allow for computer time as an expense as well as including the difference in cable and excavation costs between the manual and automatic designs.

The computer programme can be designed with safeguards arranged to stop the machine if it should depart from its intended sequence owing to a computer breakdown. These safeguards act very rapidily and in consequence the design is not only virtually error free, but it will also reveal mistakes included in comparable manual designs.

Computer Merits

The great merit of the computer lies in its capacity for detailed examination of many alternative schemes. For the estates given in the table, computer time is likely to vary from 10 to 40 minutes, giving a cost of up to £50, this cost has been included in the table, but the cost of manual design has been omitted. Although the computer saving may not be as great as that shown in the table on all occasions, in all cases it showed improvements on manual designs and has the advantage that cost figures prepared for alternatives are readily available. These would be valuable in negotiating for suitable substation sites. Transmission losses are not included in the calculation because of their relative unimportance when compared with copper cost, but the programme could readily be modified to include them.

The results of the calculations show that experienced engineers achieve designs agreeing closely with those obtained by the computer, but detailed examination shows the computer to give more economical distribution systems. Savings on the designs ranged from 6 to 15% of the capital expenditure on m.v. mains required for previous manual designs.

Logical design of Networks

The paper by Mr Knight was concerned with the more general aspects of the supply problem. It suggests a mathematical method of designing a minimum cost network supplying a number of load points from a number of supply points. By starting with the geographical positions of the substations, it is demonstrated that a set of equations can be obtained which are solvable by linear programming techniques. The solution of the equations requires a digital computer, and one of the envisaged limitations of the method is the rapid increase in the number of equations with number of substations. However, the paper includes suggestions for increasing the size of problems which can be dealt with by a given computer.

The method involves the formulation of a number of linear equations representing the variables and their restraints. Although a large number of solutions may be possible, the object of the analysis is to find that solution which has some preferred characteristic, for example, minimum cost. Linear programming enables the preferred solution to be obtained in a systematic manner and also identified.

Linear programming can be used to ensure that the cost of construction and operation of a network is as small as possible, that adequate continuity of supply is ensured, and that generating station connections give adequate capacity out of the station under outage and load conditions as are considered justified during the design study. Duplication of supply, voltage regulation and reactive capacity must also be allowed for in the design and constitute factors whose relative importance will depend on the nature of the system and whether it is a high or medium voltage network. Linear programming would thus seem to form a valuable complementary technique to the present use of network analysers and digital computers, and although it may not necessarily lead to economies, if it achieves only a marginal saving on the estimated £100 million invested annually in transmission networks it will repay investigation.

DISCUSSION

MR T. R. WARREN (SSEB) opened the discussion. He emphasised that the computer could not investigate principles, but that it could prove valuable in solving transmission and distribution problems. With Mr Knight's linear programming system, it would seem that broad decisions regarding substation location must be made by the design engineer and he wondered if, in fact, the computer had been given enough work to do. With the introduction of the 275 kV grid and the possibility of future voltages of 500 kV he was a little alarmed at the number of transformations required.

Since the CEA report, housing estate costs have been reduced from £90 to £50 per house and with the author's computer analysis further economies could be expected. A number of engineers were averse to the practice of tapering cable layouts, on which the paper was largely based. Recent investigations also suggested that the a.d.m.d. figure of 3 kW, in use for some years, should now be 6 or even 8 kW and on some estates, had reached 15 kW. The figure was also criticised by Mr Stubbs (LEB).

MR J. G. MILES (AEI) saw Mr Knight's paper as the basis for using digital computers to solve complete network analysis problems rather than isolated parts, although the method was at present restricted by being confined by linear restraints.

MR L. J. L. EGGINTON (CEGB) thought that the number of substations selected by the machine could be shown to be incorrect, especially if other facilities, such as future capacity, was taken into consideration. He asked how long selection of sites took the computer.

MR J. H. WENSLEY (Computer Development Ltd.) asked for some information on those cases where the method broke down, for example, could it be applied to ribbon developments?

No great expectations of radical improvements had been anticipated when the suggestion to make a computer analysis was proposed, but MR H. J. SHEPPARD (YEB) felt that it proved a worth while check on existing design methods. The computer solution had to be watched critically. For instance, no engineer would like to put 120 houses on one feeder and he would avoid a free standing site when a convenient garage site was available nearby at reduced cost. An average saving of 4% found on the estates checked by the computer amounted nationally to £10,000 per annum, was this sufficient justification for establishing a computer centre?

MR T. W. BERRIE (CEGB) thought Mr Knight's technique would provide an unbiased template by which to judge schemes, but at present it was restricted by the need to use linear equations and the limited number of substations which could be handled.

MR D. G. TAYLOR (EEC), referring to Mr Knight's paper, said that there were a finite number of configurations for a given number of substations if the circuits per path were restricted to two.

MR G. S. BUCKINGHAM (MEB) emphasised the importance of an investment policy allowing for adequate future development. The computer would enable more accurate design of future transmission and distribution systems, but there would be trouble if a figure of 3 kW for the a.d.m.d. was adhered to; figures of 14 and 15 kW were becoming possible, calling for substantial differences in l.v. distribution network layout.

Other contributors were Mr J. I. Bird, Mr H. Dreyfuss and Dr P. D. Aylett.

DR GRIMSDALE, in reply, said the computer was vastly more accurate than human calculation and that intelligence could be built into future machines. Computers now being introduced would take only seven milliseconds to carry out the substation selection calculation, but he saw the computer as a means of saving manpower rather than money.

MR KNIGHT said that it was true that man had an overall conception of a problem, but a computer will eventually get the right answer.

Instruction in Holger-Nielsen

by D. Sanderson*

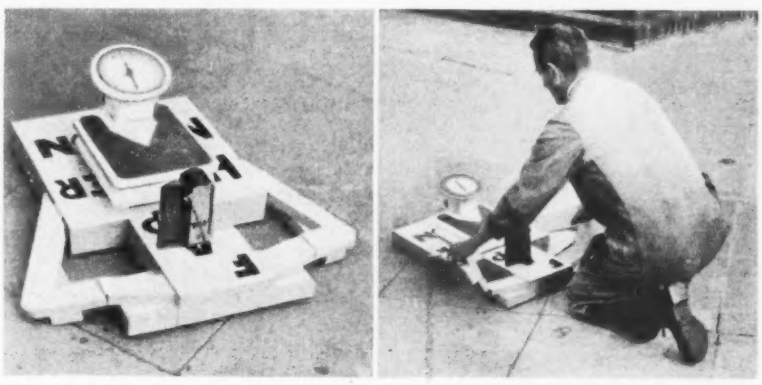
AN apparatus for demonstrating the Holger-Nielsen method of artificial respiration has been made up from a base, 2 ft by 1 ft 6 in., made from a frame of 2½ in. by 1 in. planed wood, covered with plywood. This represents the body of the patient. A similar piece 9 in. by 12 in. is joined to this to represent the head. In order to fit the arms, two pieces of wood are attached to the "head," extending outwards to the level of the shoulders. Two pieces of wood should be joined to form the remaining part of the arm. If there is any difficulty in joining these at the correct angle, it is a good idea to ask someone to lie in the position for the Holger-Nielsen method of artificial respiration and then to mark round him with chalk, from the waist to the head (not forgetting the opening caused by the arms). The correct angle is then shown. These completed pieces should be fitted to the shoulders and forearms with butt hinges. An eye screw should be fitted under each "elbow" to which is attached a spring which extends from one "elbow" to the other. The best spring to use is the type used on motor cycle carriers, as this will ensure sufficient tension and give the feeling of pulling against the arms of a patient.

When this is completed, place the bathroom scales on the "back" of the "patient" and a metronome on the "head." The metronome should be set at 60, and arranged to ring every six beats.

To perform the Holger-Nielsen method of artificial respiration, kneel on one knee, at the head, with the other foot opposite the point of the elbow. Place both hands on the platform of the scales and apply 4 lb pressure. This assists expiration. Move the hands along the arms, grip the elbows and lift. This assists inspiration. Lower the elbows and move hands back to the scales. You are now in the position for starting the operation again. This should be completed every six seconds.

One advantage of this model is that since it incorporates a pair of scales, it enables trainees to become accustomed to applying the correct pressure. It also eliminates the need for anyone to play the part of the patient, and there is no risk of sore or cracked ribs at the end of practice.

* Mr Sanderson is class secretary of the ambulance section at Lincoln Power Station, CEGB, Spa Rd, Lincoln. He is willing to help any readers who may wish to construct the apparatus.



Left, demonstration apparatus for practising the Holger-Nielsen method of artificial respiration in position, showing scales and metronome. Right, the equipment in use showing the elbow-lift movement

Contractors and trading

FAIR COMPETITION AND PRICES URGED AT E.C.A. DINNER

TRADING and prices featured prominently at the Electrical Contractors' Association dinner last week at Grosvenor House, being touched on by both the President, Mr V. J. Stock, and his chief guest, Mr W. H. McFadzean, chairman of BICC and this year's President of the Federation of British Industries. The latter, in proposing the toast to the "Association and its Allied Bodies," contrasted the general expansion in industry as a whole with the less fortunate position of the cable industry.

Whilst admitting that changes in the cable world were inevitable, he expressed the disquiet felt by many that such changes degenerated into chaos, from which wholly uneconomic competition ensued. Sensible, clean competition was acceptable, but price cutting such as has taken place in the cable industry benefited no one, not even, in the long run, the consumer and certainly not to those in the industry with continuing responsibilites for research and development on the one hand and the welfare of thousands of workpeople on the other.

Self-discipline

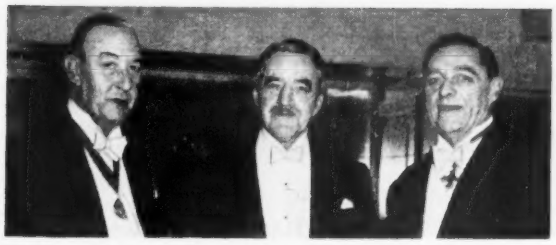
Since trade associations these days are generally regarded as illegal, the only fundamental way of correcting this situation was the imposition of a self-discipline by the industry. There were encouraging signs that this self-discipline was being achieved; there are some prospects of efficient producers earning some return on their capital and efforts.

Referring to the National Inspection Council, Mr McFadzean saw this as a useful start towards ensuring that electrical installations in new buildings were competently carried out. He regretted, however, that inspection was still limited to those who voluntarily join the NICEIC, and are those who would be unlikely to tolerate shoddy workmanship in any case. He felt it was not an unreasonable interference with individual liberty to ask a man who sets up to be an installation engineer to accept an unbiassed report on his work, bearing in mind that his client is quite unable to assess it for himself.

Fair Trading

In reply, the President took up the trading theme by suggesting that the ECA, despite actively attempting to achieve fair trading, had failed to persuade industry that fair trading was desirable. Perhaps industry preferred the jungle to the fertile plains of regularised trading. The Fair Trading Council was scarcely more than the echo of a lost hope; it had a wonderful rule book which provided a source of unending discussion between representatives of trade organisations, but which was honoured more in the breach than by the observance.

1, C. T. Melling chats to Sir Willis Jackson, G. F. Peirson and Sir Josiah Eccles. 2, Prof. F. Sewell Bray, Sir Leslie Gamage, G. J. Briggs, H. J. Campbell and L. C. Penwill. 3, D. B. Irving, N. F. Marsh, G. J. Briggs and S. L. M. Barlow. 4, W. E. Hind, R. R. B. Brown, N. Aish and R. M. Fairfield



ECA President, V. J. Stock with Mr McFadzean and Mr Penwill

He placed a large part of the responsibility for the breakdown of the electrical industry's trading structure on to the shoulders of the wholesalers. Contractors demanded special terms from wholesalers only because wholesalers had tried to secure the bulk orders which properly belong to manufacturers, and which to wholesalers were only paper transactions. Contractors demanded special terms only because wholesalers were prepared to give the same trade terms to contractors' customers, despite the fact that wholesalers were no worse off by selling through contractors. If money at present given away to consumers were retained in the industry, there would be much less call on wholesalers to act as finance houses to needy contractors. He also argued for parity of trade terms to contractors on the one hand and to area boards, departmental stores and other bulk purchasers on the other.

Since the Association has had its share of labour troubles, it was natural to expect some comment from the President on this score. He argued that the Minister of Labour's special inquiry on the Shell building dispute was not because a small number of electricians had gone on strike, but because it was feared that a large number of building operatives would become redundant and the completion of the building delayed. As the NFEA's stand, on the principle that agreements made between parties shall be honoured until either party gives notice of termination, had been fully justified by the investigating committee's findings, the President took exception to suggestions from other quarters that contractors had no right to refuse demands made by the ETU, and that, in supporting contractors in their refusal, the NFEA was being pedantic. It was with some bitterness that Mr Stock asked if belief in negotiation, and belief in the sanctity of agreements, was being pedantic.

In industrial relationships today, he suggested, the only people who have to keep agreements are employers; the word "negotiation" means acceptance of trade unions' demands made under threat of strike action if they are not met. This situation existed because trade union members were not afraid to lose one week's pay, whereas employers were not prepared to lose a week's profit.

"The Guests"

That difficult toast "The Guests" was made more difficult for its proposer, Mr C. J. Veness, ECA Vice-President, in that he was standing in, at the last moment, for Mr C. R. Waterhouse, but he acquitted himself well, paying tribute to professional interests, customers and suppliers whom the occasion gave opportunity to meet.

In reply, Mr C. R. King, C.B.E., COMP.I.E.E., chairman of the Electricity Council, said that he had always looked on contractors as being the best unpaid canvassers the supply industry had. He felt that any fears contractors might have had over the 1947 Act had been proved unjustified; there was room for both private and area board contracting and it was good practice that the generating board and most area boards were placing wiring contracts with contractors on a competitive basis. He foresaw a growing value in the work of the NICEIC and hoped that it would lead to no installation being carried out by other than a registered contractor.

On the British approvals authority for appliances, he saw a position where it would be possible, if every appliance were tested and improved, to get rid of shoddy design and all the dangers implied. If it saved only one life each year, it will have achieved something.

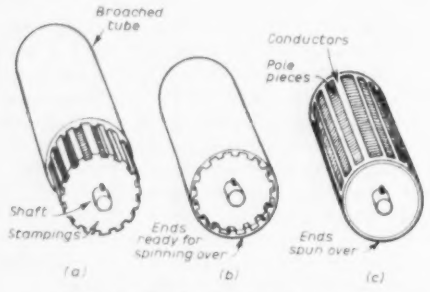
1, S. F. Steward chats to R. M. Fairfield. 2, G. N. Walker and S. N. Watkins. 3, R. L. Booth, N. Aish, H. S. Watkins. 4, C. R. King, W. H. McFadzean, C. H. Broughton Pipkin, L. C. Penwill. 5, D. L. Tabraham and C. J. Veness. 6, F. J. Blackwell with P. B. Etheridge

PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Squirrel Cage Rotor Design

There are a number of ways in which the squirrel cage rotor of an a.c. induction motor can be constructed. In the larger types the conventional method is by the use of copper bars inserted in the slots and riveted to end rings but, for small motors, squirrel cages are nowadays more usually cast in the slots from aluminium. In an endeavour to ensure completely a solid casting, free from blowholes, centrifugal methods are sometimes used but, whatever the method, there is always a chance that the resistance of the bars may vary from slot to slot with subsequent reduction in performance.



Method of fabricating squirrel cage rotors

In a method described in patent applicaton 827,269, and credited to Ketay Ltd., of Vicarage Lane, Ilford, a solid aluminium tube has a number of axial grooves slotted or broached on its internal diameter to coincide with the grooves and poles on the laminated rotor core, the dimensions being such that, when forced into place on the rotor, the projecting lands completely fill the grooves between the pole pieces and are a tight fit. The slotted tube, which is made slightly longer than the rotor, is then spun over to make homogeneous end rings after which the outer surface of the tube is turned down to the level of the laminated pole faces.

It is claimed that this method produces a squirrel cage in which the bars are uniform in resistivity and cross section; moreover, it is a cold process which can be used in production without expensive tooling and at comparatively high rates. The method applies to squirrel cage rotors with straight or skewed pole pieces or, alternatively, straight bar rotors could be used with skewed stator poles.

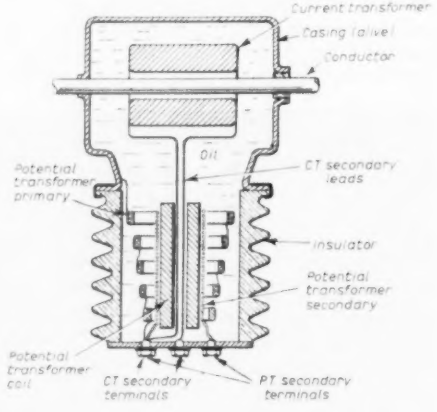
Encapsulating Methods

Encapsulation, or the enclosure of electrical components within cast resin housings, is a technique which has expanding applications these days. A point which has not received much attention is dealt with in AEI patent specification 827,097 wherein two or more components are required to be encapsulated within a single resin housing but where the type of resin for one component is, of necessity, to be different to that for the others. The technique adopted is one in which the housing itself is cast in the resin suitable for the majority of the related components. For those requiring a different resin, a cavity is left within which the remaining components are subsequently located after which the cavity is filled and closed by another type of resin more suitable to the particular requirements of the component.

Choice of resins is important, both in regard to the components and to each other, as stresses may be set up in the primary and secondary casting processes and/or by subsequent temperature variations in service which may weaken the assembly or, alternatively, vary the performance of the components if they embody pressure sensitive materials, such as nickle-iron dust compressed magnetic cores or compressible capacitor assemblies. The specification also describes means of accurately locating the secondary components within the main housing.

E.H.T. Potential/Current Transformers

In patent specification 827,097, in the name of British Thomson-Houston (now AEI), the problem of providing both potential and current transformation for metering and protection is solved in a neat and effective manner which is clearly shown in the accompanying diagram. The high voltage conductor is passed through a metal



Combined potential and current transformer assembly for high voltage systems

housing which encloses and supports a current transformer of the straight-through type and also, within an insulating bushing, a potential transformer the primary windings of which are graded and connected between the live metal housing and an earthed terminal on the base-plate. The space within housing and bushing is filled with insulating oil. Arrangements on the terminal plate provide a common terminal for one end of both current and potential transformer secondaries as well as for the earth connection of the potential transformer primary. Separate terminals are provided for the remaining secondary connections.

Reproduced by permission of the Controller of H.M. Stationery Office. Copies of specifications may be obtained from the Patent Office (Sales Branch), 25 Southampton Bldgs, W.C.2. Price 3s 6d.

Experts on Exports

B.E.A.M.A. APPLIANCE EXPORT CONFERENCE

ALTHOUGH the electrical industry has a fine record of achievement in the export field, it must be admitted that some sections of the domestic appliances industry have been facing severe competition from European and other manufacturers, who have not had restrictions placed on their home market activities as we have had here. One of the first major moves by the newly formed Domestic Appliances Division of BEAMA has been to call a conference so that the urgency of the problem can be brought home to the industry.

With this concise summing up of the current situation in the field of electrical appliances, Mr. S. Broughton, managing director of Electrolux Ltd., set the tone for BEAMA's enterprising one-day Domestic Appliances Export Sales Conference held in London last week, attended by more than 200 executives of nearly 90 firms in the appliance industry. Under the general title "Re-arm for Export," the Conference, with Mr. Broughton in the chair, set out to stimulate a new vigorous attack by the industry on overseas markets. Almost every aspect of export policy and practice in relation to appliances was examined and discussed by a distinguished panel of speakers, headed by the Rt Hon Reginald Maudling, President of the Board of Trade.

Disappointing

It was disappointing that the volume of export sales in domestic appliances last year was no bigger than in 1955, Mr Maudling told the Conference, but the industry should regard this as a challenge. Although last year Britain's total exports increased, Western Germany did better. He gave three cogent reasons why there was an urgent need to increase exports: (i) our imports were rising rapidly; (ii) our gold reserves were inadequate, standing at a level of about one third of Britain's short term liabilities; (iii) there was a growing need for the UK to increase foreign investment and give more aid to uncommitted and undeveloped countries, particularly where Communist influence posed a threat.

Mr Maudling suggested that increasing prosperity throughout the world was producing a "middle class demand" for durable consumer goods, in particular domestic appliances of all kinds. With a strong home market it should now be possible to build up exports to higher levels, broadening the basis over more countries instead of concentrating on just a few.

"Pay particular attention to Outer Seven markets," he added. "The Government cannot act alone to ensure the success of the EFTA. A positive trading effort is required from manufacturers."

Mistaken Policy

In the early post-war years the Government of the day held the appliance industry to a low output by various stringent measures—allocation of materials, high purchase tax, severe credit restrictions, Lord Chandos (chairman, AEI) reminded his audience. This policy, although effective at short term and with a limited objective, was designed to free the nation's resources for export. But in the case of domestic appliances it had exactly the opposite effect. Western Germany and Italy, recovering from their post-war difficulties, entered the appliance market on a large scale and, based upon a large home demand, started to eat into British export business. The restrictions at home dealt our export trade a blow from which it has not yet recovered. It was a mistaken policy.

Sales of appliances in the home market revived with the end of the credit squeeze and reductions in purchase tax in 1958. Even so, the apparent ceiling is still very much above us. The density of washing machines in the UK is only 30 to 35%, compared with 91% in the USA, while the refrigerator figures are 15% and 98% respectively. The home market was now secure, and exports must assume priority.

Lord Chandos said: "I have never been to a foreign country without finding out that there are products which we could make and they would like to buy if we were willing to take the trouble, meet the prices and send out the salesmen."

Export Strategy

According to Mr S. Roberts (managing director, Hoover Ltd.), whose speech was read in his absence by Mr R. T. Griffiths (director, Hoover Washing Machines Ltd.), the three basic steps in the development of an export market are: (i) infiltration through agencies or distributors; (ii) the establishment of a sales subsidiary company; (iii) the establishment of a manufacturing and sales subsidiary, or, in special circumstances, the conclusion of agreements with a native manufacturer to produce under licence. But first an intensive study must be made of the economic background of the overseas market concerned to assess the probable growth of disposable income, the pattern of personal expenditure and the proportion of income likely to be spent in the field of durable consumer goods, in order to make a long term forecast of sales and market potential. Giving practical advice on setting up an export organisation, Mr Roberts said:

Of distributors: Initial success depends almost entirely on the wise choice of distributors or agencies, who must not only have interest and drive, but also the standing and means to provide effective local coverage. Personal contacts by highly trained export managers are essential.

Of subsidiaries: A subsidiary company, to have vitality, must have native leadership and management. It is a sound policy to establish subsidiaries in collaboration with distributors or agents. In this way the subsidiary will express within the parent company's framework the national characteristics, customs and practices.

Of manufacturing: The policy of establishing manufacturing units overseas is justified, not only from the standpoint of increased overall profit, but also because in certain countries the market cannot be fully exploited, in the face of trade barriers, in any other way.

And a final recommendation: Greater success in export can be achieved by the smaller companies if the know-how already acquired by the larger companies is used, if trade associations undertake international research to assist members and groups of companies combine together sharing common research and merchandising facilities.

Decline and Fall

We have not increased the value of our domestic electrical appliance exports in recent years, Sir Leslie Gamage (chairman and managing director, GEC) told the Conference. Exports dropped in 1957, 1958 and 1959 and last year's drop was about 7%. We sold less of the higher priced products. Sir Leslie thought, however, that the buying power in our export markets was on the increase, and that international trade was expanding. Further, we could do a lot more than we are doing in exporting our knowledge and manufacturing experience.

On the subject of competition in the appliance industry, Sir Leslie said: "I hope that members of the domestic appliance industry will not indulge in cut-throat price cutting which has bedevilled other parts of the electrical industry. Reduce prices where your rising efficiencies permit, but let us keep our price-cutting to the export field, where it will be found necessary, no doubt."

As practical steps to export success, Sir Leslie urged the industry to be bold and adventurous in appliance design, liaising with the Council of Industrial Design; to train staffs to sell overseas, and here the Institute of Export could be a useful ally; to organise adequate after-sales service and to make the most of market research. BEAMA, he thought, might undertake selective overseas market studies on a collective basis.

And finally, export had to have "number one priority" at all times. It was as vital as Defence and more so than many other things which have their own Ministry—so why not a full-blooded Ministry of Export?

Surveying Sweden

More than 99% of Swedish homes are electrified, the production of electricity *per capita* being one of the highest in the world, stated Mr Sven Jansson (managing director, Elektronikbolaget A.B, Stockholm), whose speech was read by Eric Rydman, a director of the same company. Local industry is strong and holds the major part of the market, particularly for vacuum cleaners, absorption type refrigerators, home freezers and cookers.

So far as design is concerned, Swedish taste favours the "contemporary," with a preference for smooth surfaces and moderate colour schemes. Fancy decorations are out. A great deal of importance is attached to packaging. American influence through lavish advertising has influenced taste and styling as in most Continental countries.

Total sales of domestic appliances in Sweden in 1958

		£ million
Through the trade	Refrigerators	4·5
	Deep freezers	5·2
	Vacuum cleaners Sewing machines Washing machines	6·2
	Toasters, heaters and other appliances ...	3·1
Through building contractors	Built-in refrigerators and cookers	8·5
	Total Sales ...	27·5

Saturation of appliances in Sweden in 1958

Refrigerators	52·6%	Home freezers	4·6%
Food mixers	5·2%	Vacuum cleaners	74 %
Floor polishers	1·5%	Washing machines	12·2%
Sewing machines	25·5%	Kitchen extractor fans	6·4%

Mr Jansson thought that British manufacturers tended to attach too much importance to quality, for which they had a tradition, but the clever thing was to make an appliance which was just good enough for the purpose and no better. An important factor in Sweden was the standardisation of kitchen materials, cupboards, sinks and benches being prefabricated to certain standard measurements. In turn, major domestic appliances such as cookers and refrigerators and to a certain extent washing machines, had to be made to fit the prefabricated kitchen interiors. On specific appliances, he had this to say:

Refrigerators: British exports of refrigerators to Sweden had fallen from 40% of the total import in 1954 to a mere 4% today. The reason is that British export prices are up to 30% higher than those of other European manufacturers. Also British design and features tended to lag behind competitors. Some 60% of Swedish households use refrigerators—the highest figure in Europe.

Washing Machines: About one-third are imported, and of these the UK's share was 40% in 1953 and 70% in 1958. In 1959 the share was estimated at about 50%. There is a trend in Sweden towards the bigger drum machines of the American type, combining automatic washing, rinsing and spin drying. All washing machines in Sweden must be equipped with electrical heating and thermostatic cut-out protection.

Vacuum Cleaners: Saturation of the cleaner market is high at 74% and local industry has a dominating position; consequently exports exceed imports. The UK's share in 1959 was only 10% of total imports.

Selling in Africa

The United Africa Co. operates in territories like the Senegal, the Belgian Congo, Ghana, the Ivory Coast, Nigeria, Kenya, and so on, Mr Colin Baxter (joint managing director, United Africa Co. Ltd., a Unilever subsidiary), explained. They cover an area of five million square miles and have a population of some 110 million. The African, like the European, tries to keep up with the Joneses. He has an instinctive tendency to do things the easy way, to save himself effort, and this sounds like fertile ground for electrical appliances. Although the average annual income is £30 per head, many Africans command substantial incomes, living in many ways a western life, with refrigeration, air conditioning, etc. Because of climatic conditions, products had to be purposefully designed, and robust enough for the less sophisticated user.

Mr Baxter stressed that to have an overseas selling organisation, exclusively devoted to one product, was generally economically impossible, and experience had shown that the sharing of market costs with other products, even products of the same kind, was advantageous, resulting in higher overall sales. "The geographical factor is important," he said. "It is usually better to tackle a section of the market thoroughly and energetically than have a theoretical cover of the entire area."

Finally: "It is almost impossible to overrate the importance of proper packing in the export field. All the skill and care in the world which go to produce a first-class appliance are abortive if it does not arrive at the consumer in mint condition."

Supply and Control in the Processing of Rubber

EXTENSION AND MODERNISATION AT EDINBURGH WORKS

THE processing of rubber, particularly for manufacturing tyres and hose, can present some of the most rigorous demands on electrical machinery likely to be found in any industry. In the initial processing stage, the addition of such materials as sulphur and carbon black to the raw rubber can create atmospheric contamination problems; subsequent operations of milling and calendering require accurate speed control coupled with rapid braking in the event of emergencies.

A good example of the way such problems can be overcome in practice is to be found in the works at Castle Mills, Edinburgh, of The North British Rubber Co. Ltd., which we were recently privileged to visit. The firm is now completing a large extension to their works, coupled with a modernisation programme, which provides some indication of the requirements, not only for electrical equipment in rubber processing, but also of the associated distribution system.

The works is divided by two roads into three main manufacturing areas which may be conveniently designated east, central and west. It is in the latter area that a new building with an area of 100,000 sq ft for manufacturing hose has been erected. A new 90 klb/hr boiler plant has also been installed, together with an engine room housing air compressor hydraulic pumps and other service equipment.

The new hose building is a steel frame structure 600 ft long and 160 ft wide divided into two 75 ft bays. It has a reinforced concrete floor below which a head-high services tunnel has been run for virtually its entire length. This tunnel connects at its eastward end with a cable duct running under the road to a cable room in the central area, forming part of a basement below a new substation and main switch house. The new hose building is also connected with the central area through a truck tunnel running under the road.

Intake to the site from the South of Scotland Electricity Board is at 33 kV, two feeders being provided each connected direct to the primary windings of a 10 MVA, 33/6·6 kV transformer. The secondary windings are connected to a main switchboard of English Electric type CV cubicle type oil circuit-breakers. The first five panels of this board (comprising the two 1,200 amp incomers, 1,200 amp section c.b. and two 400 amp outgoing units) are under SSEB control, forming part of the board's 6·6 kV system. The busbars of this section, however, are continued through the wall of the SSEB switchroom into the North British Rubber Co.'s main board, which is of the same gear.

On the NBR side, there are eight panels, the first being a metering panel and housing current transformers on the busbars. The remaining seven cubicles are all of 400 amp rating c.b. units, and to provide for future load growth, two spare panels have been included. In normal operation, the SSEB devotes one of its two main transformers entirely to supplying The North British Rubber Co., the second being used for other consumers in the vicinity. Should either of the two incoming supplies or transformers fail, the other can be used to supply both loads under emergency conditions.

As a precaution against the somewhat remote possibility of both main supplies failing, the firm have a third source of supply limited to 250 kVA for lighting and certain loads which require 100% continuity to maintain safety. This transformer is kept permanently available and would be switched into use by means of a changeover contactor.

Apart from the outgoing 6·6 kV circuits, which supply five substations for

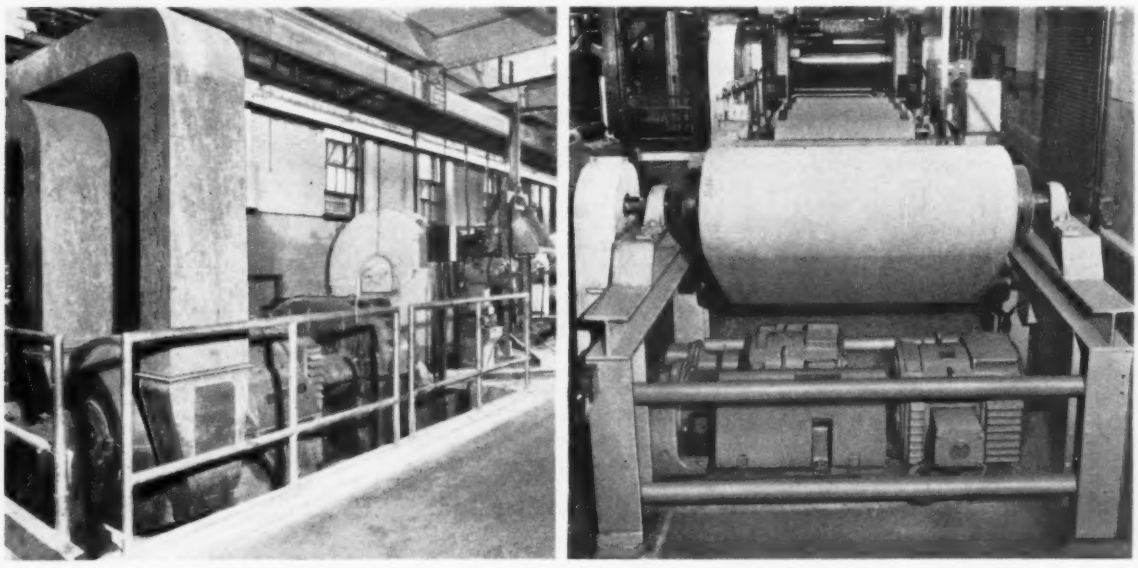


Fig. 1. Left, is drive for one of the mill lines in the tyre manufacturing section, showing use of ducting for ventilation. Right, is a view of tyre calender from fabric let-off end, with liner and fabric drive motors in foreground

works distribution, the main switchboard also feeds a 1,500 kVA, 6·6/3·3 kV transformer used to supply all motors of above 200 h.p. rating. The secondary of this transformer connects to the incoming circuit-breaker of a 3·3 kV switchboard of English Electric OB33L air-break cubicle type c.b. units from which cables are run to the individual motor starters. There is also a 1,000 kVA, 6·6 kV/415 V transformer in the main boiler plant for local m.v. supplies.

Distribution System

Main distribution throughout the works is at 6·6 kV via seven substations. Although these were in existence before the modernisation project was planned, modification was required for adaptation to the new system. Three of the existing switchboards were of early Reyrolle manufacture, most of which has been replaced, apart from the busbar chambers, with their C-type gear to achieve the required 150 MVA breaking capacity. Those units not replaced were already of 150 MVA breaking capacity rating. In the west section of the site, the two existing switchboards of Statter type DOGR 150, 150 MVA gear were retained to supply the new hose building.

The works load from the main switchboard is carried by three main distributors, one to each section. These comprise two, three-core cables of 0·2 sq in. cross section. There are, in fact, seven h.t. switchboards in the distribution system (two being housed in one substation serving the central area). Each pair of boards in the east and west areas is linked by a distributor of the same capacity as the main feeders. There is an additional interconnection of a three core, 0·2 sq in. cable between the three works sections for emergency use.

Outgoing circuits from the h.t. switchboards are, in general, transformed to medium voltage for distribution in the manufacturing areas. This transformation includes the use of a number of rotary converters for d.c. supplies. Most of the transformers are of 500 kVA rating, with a secondary voltage of 500 V three-phase, which was the original works standard. The modernisation project, however, also includes a programme of changeover to the present-day 415 V standard, which is being accomplished section by section throughout the works. There are now four 6·6 kV/415 V transformers installed, each of a new works standard of 1,000 kVA capacity. Two are used in the west section to supply the hose building, which is entirely 415 V; a further unit supplies the new engine room and boiler house whilst the fourth supplies equipment associated with the new calender and rubber mills in the tyre plant. For m.v. circuit control, "Superform" switch and fuse gear is now being employed as standard, using h.b.c. cartridge fuses throughout.

Medium-voltage distribution in the hose building follows a straightforward radial pattern. One of the two 1,000 kVA transformers supplying the building feeds a 1,600 amp, 35 MVA airbreak circuit-breaker of English Electric Type OB23. This forms the incoming unit on a "Superform" pattern m.v. switchboard with 150 amp circuit-breakers controlling the outgoing circuits and is installed at the near end of the building. These are run in 3½ core, 0·15 sq in. cable to 150 amp isolators controlling local 60 or 100 amp, tpn fuse distribution boards of Superform type.

Considering the electric motor drives in use at Castle Mills, interest centres largely on the drives for the two new calenders—one used in tyre production, the other in hose production—and for the rubber mills. Both calenders have in common the function of coating fabric with rubber. The tyre calender is a somewhat more complex unit than the hose calender, involving not only control of speed but also of fabric tension on both sides of the calender. The mill drives, on the other hand, are constant speed units, their main control requirement being rapid stopping in emergencies to safeguard operating personnel.

Tyre Calender

The arrangement of the complete tyre calender train is shown in Fig. 2, which also indicates the fabric flow. The uncoated fabric is drawn into the system from a braked let-off roll, so that the only control of let-off tension is the braking friction. It is passed over a number of heated drums to ensure maximum dryness and then passed between the lower and centre rolls of the calender. From the stock of rubber maintained between the upper and centre rolls, a film of rubber is carried round by the centre roll and pressed onto the upper surface of the fabric. The single-coated fabric is then passed onto the fabric winder drum and wound up, with a canvas liner which separates successive layers of fabric to prevent them from sticking together.

When the uncoated fabric let-off drum has been emptied, the coated fabric is passed a second time through the calender to coat its other side. During this operation, the fabric winder now becomes a let-off roll. At the same time, the liner is rewound on what was its let-off roll during the first fabric pass. On the far side of the calender, the double-coated fabric is passed over cooling drums, through a pair of tensioning pull rolls and thence to one or other of two wind-up rolls, with liner.

The calender is operated on a batch production basis, 900 yds of plain fabric

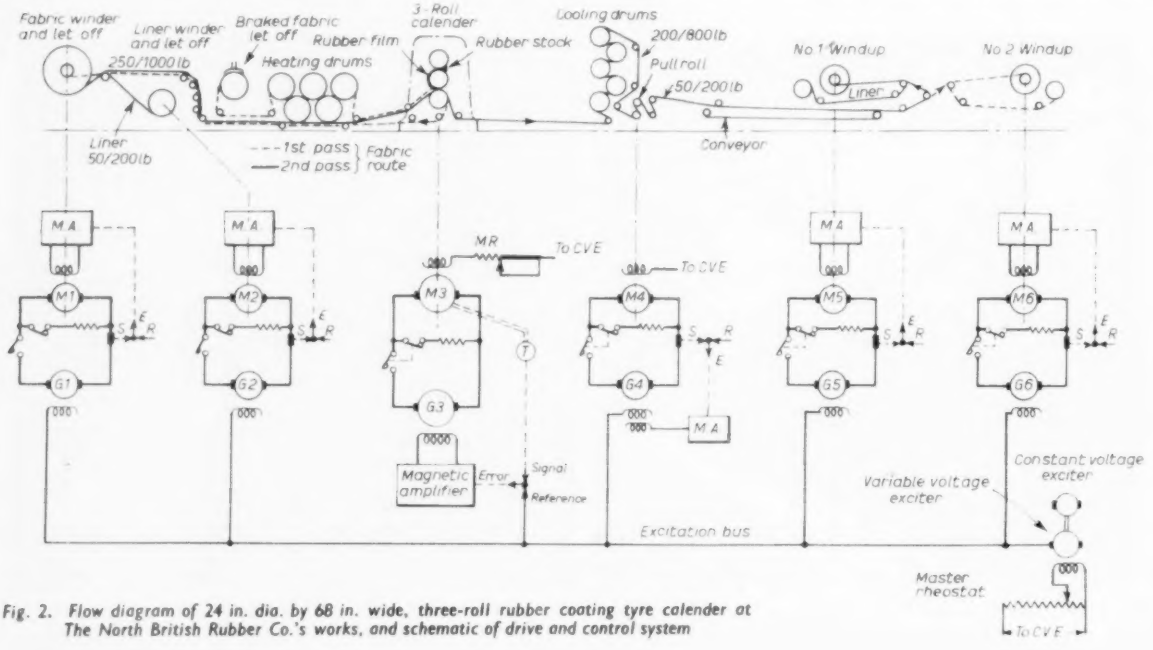


Fig. 2. Flow diagram of 24 in. dia. by 68 in. wide, three-roll rubber coating tyre calender at The North British Rubber Co.'s works, and schematic of drive and control system

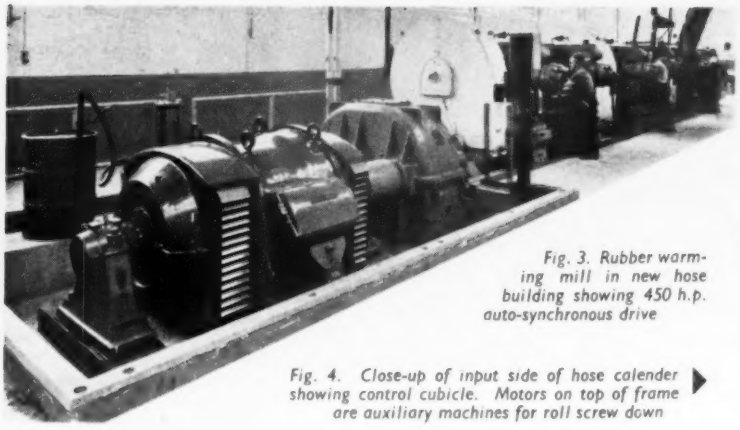


Fig. 3. Rubber warming mill in new hose building showing 450 h.p. auto-synchronous drive

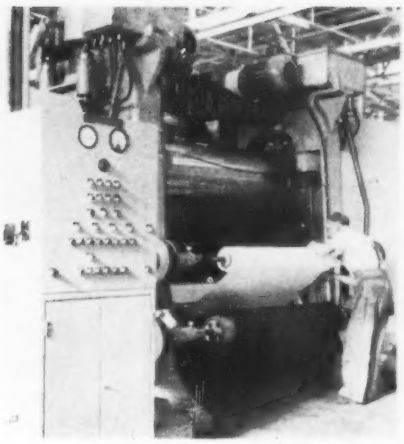


Fig. 4. Close-up of input side of hose calender showing control cubicle. Motors on top of frame are auxiliary machines for roll screw down

being processed in the two successive operations to produce three, 300 yd rolls of coated fabric. The train operates at a maximum speed of 60 yd/min during most of these operations, being slowed down only to cut each 300 yd length and transfer the moving end to the other wind-up reel, the full reel being then replaced by an empty reel ready for the next 300 yd length.

Each of the six sections comprising the complete train is driven by a d.c. motor operating on the Ward Leonard system, incorporating magnetic amplifiers in a closed-loop control system to obtain the required speed and tension matching. Simultaneous variation in speed is obtained by supplying all generator excitation systems from a common busbar connected to a variable voltage exciter. Control of the excitation voltage is then obtained by means of a master motor-driven rheostat in the v.v.e. field. The rheostat in turn is supplied at constant voltage from a constant voltage exciter.

Main Drive Control

The largest unit in the train is the calender drive, with the continuous rating of 35·3/150/150 h.p., 200/850/1,200 r.p.m., 54·2/230/230 V, corresponding to a fabric speed range of 10 to 60 yd/min. As a result of its large comparative size, this drive is used as a stable operating reference to which the smaller drives in the train are matched in speed and tension. A magnetic amplifier speed control system is incorporated to maintain the calender speed constant within close tolerances. The principle by which the control system operates will now be familiar to most engineers; a signal derived from a tachogenerator on the motor shaft, and thus proportional to motor speed, is compared to a reference, which in this case is proportional to the excitation busbar voltage and is, therefore, proportional to train speed. Up to the base speed of 860 r.p.m., the motor speed is directly proportional to the generator armature and field voltages, the latter provided by the magnetic amplifier output. The input to the amplifier is the difference voltage between the reference and signal voltages. It follows, therefore, that the motor speed is proportional to the error. Motor speed variations due to load changes are automatically compensated for as the tachogenerator brings about a change in error.

An additional feature of the main drive is the supply of the motor excitation from the c.v.e. output through a rheostat coupled to the master rheostat. As will be seen from Fig. 2, however, this rheostat provides variation in excitation over only part of its travel, the lower part. This section covers speeds from 200 to 850 r.p.m. the reduction in field current giving a constant driving torque over this section of the speed range. Over the remainder of the range, from 850 to 1,200 r.p.m. the design of the plant will accept a decreasing torque, thus allowing the generator voltage and shaft horsepower to remain constant.

Speed control of the other drives in the train, although basically tied to that of the calender, is additionally determined by the requirement that fabric tension is to be kept substantially constant at the value chosen for a particular run, which value is determined by the type of fabric and thickness of rubber coating. Hence, for wind-up or let-off operations, speed variation of the individual drives is required to cater automatically for the changing roll diameter.

Tension Control

During the first pass, the tension of the fabric emerging from the calender is maintained constant by the fabric winder. The winder drive has a rating of 1·27/7·5/7·5 h.p., 83·3/500/2,000 r.p.m. Its maximum speed is that at the commencement of build up, with the shell at its smallest diameter, and the motor field in the weakest condition. As the roll diameter increases, it is necessary to increase the driving torque to maintain the tension constant. At the same time, of course, the shaft speed must be reduced to maintain a constant fabric linear speed.

At the start of winding-up, the motor excitation can be regarded as constant. As the diameter of the wind-up roll increases, it will tend to increase the linear speed of the fabric but as the fabric speed is fixed by the calender, the outward result is an increase in fabric tension. This creates a demand for an increased driving torque from the motor and, since the excitation is as yet unchanged, the load on the motor tends to rise, causing a rise in armature current.

By means of a small resistor in the armature circuit, a voltage signal proportional to armature current can be readily obtained, and this, as shown in Fig. 2, is compared to a fixed reference voltage whose value can be varied to obtain the desired tension over a range from 250 to 1,000 lb. The armature current signal will rise slightly with increasing armature current resulting from increased tension, creating an error signal which provides a suitable input to a magnetic amplifier supplying the field windings. The amplifier is designed to increase the excitation output as the signal input rises.

As the fabric is being wound up during the first pass, the liner roll is unwinding, so that an increase in motor speed is required. Under this condition, the liner roll and its drive act as a restrainer to establish tension within a basic design range of 50 to 200 lb. The motor acts, of course, as a generator but the control system is identical, merely operating in reverse. The liner drive has a rating of 0·33/2/2 h.p., 83·3/500/2,000 r.p.m.

During the second pass, the roles of the fabric winder and liner winder are reversed, the former now acting as a restrainer to control fabric tension between it and the calender for the application of a second coating. Further tension control is now required on the far side of the calender during the fabric's passage over the cooling rolls and for winding up. Since the wind-up tension has to be one-quarter of that required for calendering and cooling, a driven pull roll is introduced after the cooling drums, its motor rating being 1·25/7·5 h.p., 291·6/1,750 r.p.m.

The operation of the pull roll is basically similar to that of the fabric wind-up, with the essential difference, of course, that it operates at constant speed to maintain constant tension. For this reason, the motor excitation is fixed, being derived from the constant voltage exciter supply, adjustments of torque

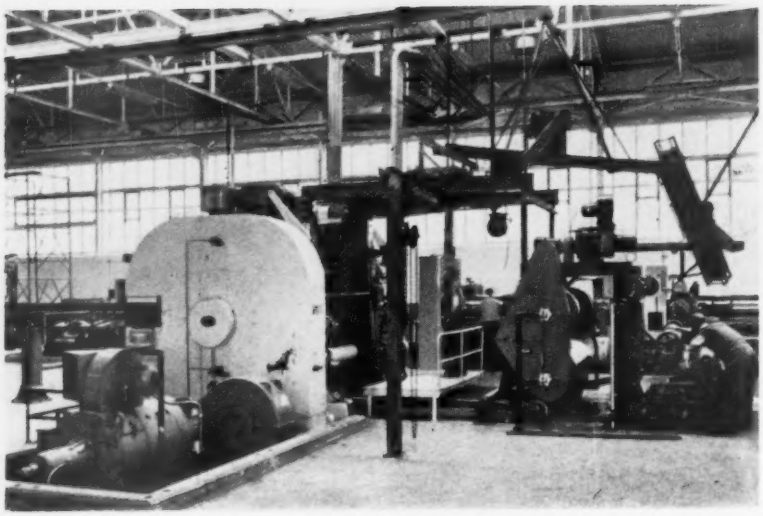


Fig. 5. General view of hose calender, showing 150 h.p. drive motor and forced ventilation intake on left foreground. Also seen is the overhead conveyor system delivering rubber from the warming mill line (in background) to the calender

being effected by armature current variation, this being obtained from a separate trimmer field on the generator, opposing the main field. The greater part of the generator excitation is, of course, provided by the main field, which is energised from the excitation bus.

In common with the wind-up control system, a signal is derived from the pull-roll motor armature current and compared to a voltage reference which represents the desired fabric tension. The difference between the two provides an input voltage for a magnetic amplifier controlling the trimmer field. Any change of tension (for example, a drop) in the fabric will momentarily decrease the load on the pull-roll motor, causing the armature current to fall. The difference signal will thus decrease correspondingly, reducing the output of the magnetic amplifier, and hence the current passing through the trimmer field windings. Since the trimmer field opposes the main field, the net result is an increase in excitation which restores the armature current, and hence motor torque, to its original value.

In the concluding operation in the train—winding-up of the double-coated fabric—speed and tension control is obtained by the same system as that employed on the first fabric wind-up.

A further feature of the tyre calender unit is provision to alter the gearing between the bottom and centre rolls from the even-coating ratio to one at which the bottom roll rotates at two-thirds the speed of the centre roll. Under these conditions, the rubber coating is rubbed into the fabric, a process known as frictioning. The fabric follows the bottom roll speed requiring the speed of the auxiliaries to be reduced during frictioning so that they operate at two-thirds calender motor speed.

Control gear glossary

Comments have been recevied on this feature of last month's "Industrial Electricity" (p. 97, 21 Jan. issue), which we hope to publish shortly.

Operation of the calender unit is centralised at a master control panel adjacent to the calender. All necessary operations are carried out from this panel, apart from tension control for the fabric and liner drives and the two wind-up drives, for which local panels accommodate tension control rheostats ammeters, and inch push-button.

The master panel accommodates push-buttons for the m.g. sets for start, thread, run, stop, calender inch, and the like, together with a preset speed control device, speed indicator, pull-roll tension rheostat, ammeter and pass-selection switches. There are also operating and alarm indicating lamps, the latter forming part of an alarm system to show those safety devices which have operated to stop the unit. The entire train is surrounded by a system of safety wires, each wire having its own alarm.

Stopping whether under emergency or normally, is required to be carried out with the minimum of fabric travel. The inertia of the drives is low enough to enable them to be stopped sufficiently rapidly by means of conventional dynamic braking.

Motor Room Plant

Main and auxiliary m.g. sets for the train are housed in a separate motor generator room remote from the calender, together with control gear and switch cubicles. There are four m.g. sets: one of 195 h.p. driving the calender generator, one of 35 h.p. for the remaining generators of the train and two of 50 h.p. driving the two exciter generators for the two associated rubber mill lines. All are standard ventilated-type machines, as are the motors for the auxiliary drives in the calender train. The main calender drive, however, is forced-ventilated, carrying a motor-driven fan on its upper casing, with filtered air intake. A pressure switch on the intake switches off the calender motor if the ventilation fails. Starting of the main m.g. set synchronous induction motor and auxiliaries is direct-on-line. To ensure reliable operation of the gear, and minimise contact contamination, the motor generator and control room is force ventilated with filtered air intake.

The hose calender, although basically similar to the tyre calender, differs from it in being more versatile in the use to which it is put but is employed only for single coating, whilst there are only two auxiliary drives. Its main function is to coat square-woven fabric with rubber for use in building hose. It is also used to produce rubber sheet.

The train comprises calender, cooling drums and wind-up, all of which are driven. The bare fabric is passed into the calender from a friction let-off; a similar arrangement is adopted for the wind-up liners. A further important difference is that there is no tensioning between sections. The control system is, therefore, designed to give close speed matching, with a facility for fine adjustment.

The three drives are virtually independent, having in common only a speed reference voltage derived from a master rheostat. The main calender drive and its control system is identical in all respects to that of the tyre calender. The cooling drums are also driven by the Ward Leonard method, with a control system similar to that of the calender. A control rheostat is incorporated, however, to give small adjustment of the cooling drums' basic speed determined by the master reference to suit particular processes.

The wind-up reel motor is also on Ward Leonard control but is normally run at constant speed. The Ward Leonard connection provides the means of setting the base speed; variation of that speed is effected by means of a slip-ring clutch through which the reel is driven, whose torque is increased as the wind-up diameter increases. To obtain a nominal degree of accuracy, an automatic voltage regulator is provided in the form of a magnetic amplifier to maintain the generator voltage constant, working from the reference voltage which also governs the cooling drum speed. The motors for these two drives are identical, with ratings of 0·65/3 h.p., 200/1,600 r.p.m.

Warming Mill Drive

As mentioned earlier, the other notable drives in the installation are those for the warming mills. These are of the horizontal 60 in. wide by 22 in. diameter two-roll type, the stock of rubber being placed on top of the nip between the rolls, from where it is carried round between them, to improve the texture of the material and warm it for calendering.

It is the operator's task to feed the stock of rubber into the top of the mill, having to reach over a bar running the length of the machine to do so. The position of the bar is arranged so that an average man is not able, normally,

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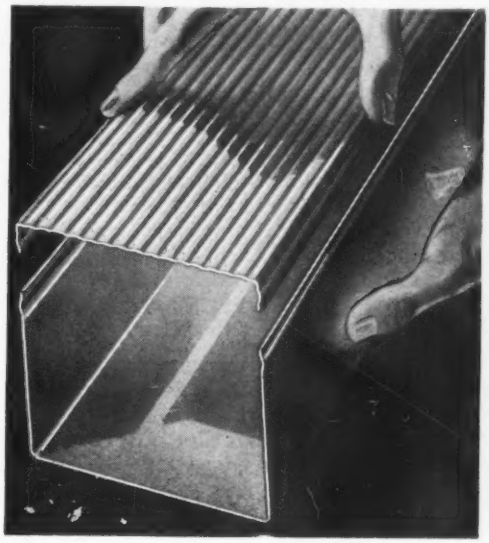

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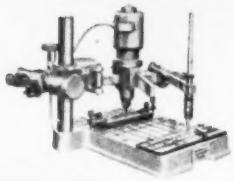

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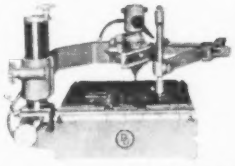

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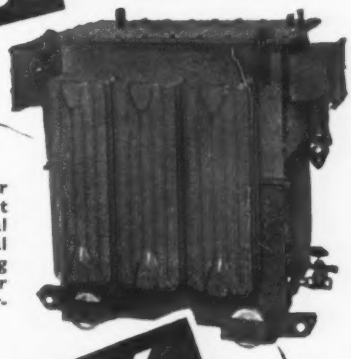

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to extend his fingers beyond the top of the nearest roll. Any attempt to reach further into the mill results in the operator depressing the bar, which actuates a safety switch to open the motor control circuit and stop the mill. The same result would be obtained if the operator had caught his fingers in the rubber and was in danger of having them carried into the nip. To prevent this occurring, a dynamic braking system has been incorporated to bring the mill to rest in 8 in. or so of roll periphery travel from operation of the trip bar switch. This corresponds to about three revolutions of the drive motor.

There are four warming mill lines installed, comprising two or more mills in tandem, driven by one motor, which is of the auto-synchronous type. Three machines are rated at 450 h.p., the fourth at 250 h.p., all running at 600 r.p.m. All are ventilated type, and for those installed in the motor tyre department, it has been found necessary to duct ventilation air from atmosphere.

All motors are similarly controlled by air-break contactor equipment, with normal rotor resistance starting, changing to synchronous running automatically. Special attention to design was required to ensure that, for stopping, the contactor operating time from the operation of the switch to the closing of the dynamic braking equipment was kept to a minimum. Dynamic braking is achieved by disconnecting the motor stator from the supply and connecting a three-phase resistance across its terminals, whilst maintaining the field connection to the exciter.

We wish to acknowledge with thanks the assistance of the Project Department of the North British Rubber Co. Ltd., and Electrical Plant Sales Department of the English Electric Co. Ltd., for assistance in the preparation of this article and for permission to publish.

OUTPUTS FROM VARIABLE SPEED MOTORS

by F. BRASSINGTON,* A.M.I.E.E.

MANY machines used in industry increasingly call for the fitting of a variable speed motor. Lifts, rolling mills, conveyors and machine tools instantly spring to mind in this connection and it is the machine designer's task, in co-operation with the installation electrical engineer, to select a suitable type of electrical drive from the many variable speed arrangements that are available today.

When large horsepowers are involved and where a very wide range of speed variation is required, the choice falls on a Ward Leonard system, a grid-controlled mercury arc system or an a.c. variable speed commutator motor. Torque and speed characteristics under these circumstances are important factors which need very careful selection if the electrical drive is to be economically and efficiently used.

For the smaller installation however, where mechanical methods are ruled

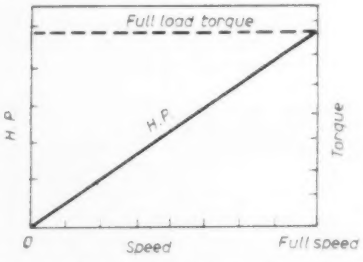


Fig. 1. Variable horsepower with constant torque

out, various other devices and types of motor can be used. The eddy-current coupling can be employed of course but this involves large energy dissipation at the low speeds. This coupling usually has a speed characteristic which is a function of the load unless automatic arrangements are made to strengthen the coupling magnetic field as the load increases and vice versa, on any particular speed setting.

Constant maximum torque is available over nearly the whole speed range. When selecting electrical variable speed devices the terms "variable horsepower with constant torque" and "variable torque with a constant horse power" are constantly cropping up. A full knowledge of their meaning is essential if the ordered equipment is to satisfy speed and torque requirements, especially where prospective peaky loads demand an estimate of r.m.s. powers of the drive.

"Variable horsepower with constant torque" implies that throughout the whole speed range the maximum torque available is constant, i.e., if the maximum torque of a motor is x lb feet, then at all speeds from zero to maximum the motor will not be overloaded when providing this torque, although the horsepower produced will vary directly as the speed. Maximum horsepower is developed at full speed.

Such a motor as the a.c. commutator type (shunt characteristic) either stator or rotor fed, fills this bill together with the d.c. shunt motor fed by a variable voltage generator. Fig. 1 illustrates their torque and horsepower relations with speed.

"Variable torque with constant horsepower" means that, throughout that portion of the speed range which is variable, full load torque available decreases with increasing speed. This characteristic can be provided by a d.c. shunt motor fed from a constant voltage supply with, say, 2 to 1 or 3 to 1 field weakening range, i.e., full field up to x r.p.m. (basic speed) and from thence upward to y r.p.m. the field is gradually weakened to give the speed ratio required. Field weakening to increase speed is of course based on the well known principle that the speed of a d.c. shunt motor supplied from a constant voltage is inversely proportional to the total magnetic flux.

Without field weakening, that is at basic speed, when developing full load torque, the horsepower is at its rated maximum. With increasing field weakening, the full-load torque available decreases with increasing speed until at full speed, the torque proportional to rated h.p. is at a minimum, although the horsepower is the same value as it was at basic speed, having remained at this value throughout the whole field weakening range. Fig. 2 shows these relationships assuming a field weakening ratio of 2 to 1.

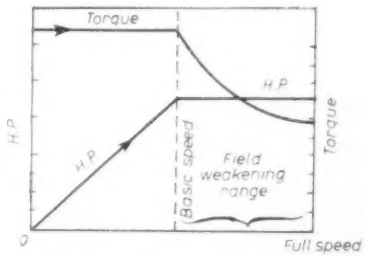


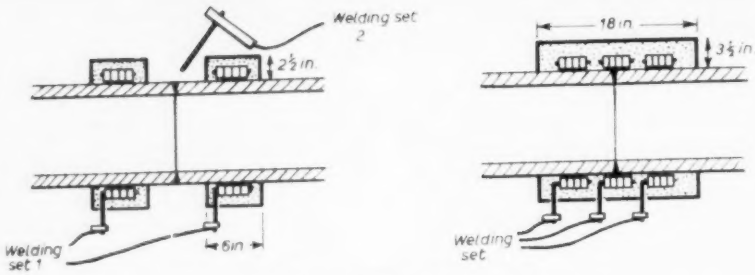
Fig. 2. Constant horsepower with variable torque

Such a motor is suitable for a machine tool where heavy work, demanding maximum torque, is required at low speeds, the lighter jobs calling for low values of torque being carried out at high speeds. If, on the other hand, a job calls for maximum torque at all speeds, such a motor would be unsuitable as it would be excessively overloaded in the field-weakening range if maximum basic speed torque was demanded right up to full speed. A suitable motor to satisfy these conditions would be the "constant torque variable h.p." type as described earlier in these notes.

Where a job calls for heavy work at low speeds and light work at high speeds, provided a d.c. supply is available, it is cheaper to install a d.c. shunt wound motor with field weakening over the required range than to install a variable speed commutator type motor (shunt characteristics) or a variable voltage d.c. arrangement giving increasing speed with increasing voltage (variable h.p. with constant torque).

* Mr Brassington is with Smiths Switchgear.

ELECTRIC HEATING FOR STRESS RELIEF



Arrangements for preheating (left) and stress relieving

WHEN heavy steel structures and pipes are welded, metallurgical considerations often point the desirability of preheating and of stress relieving by heating after the welding operation has been completed. A firm which gives specialist attention to this work is the Cooper Electroheat Co. At times, induction heating has been used. In this technique, cable is coiled round the vessel to be heated, and fed at mains frequency, the vessel being heated by the eddy currents induced in it. However, in some recently published notes, Cooper's point out that, due to interference with the electric welding arc caused by the magnetic field of the coils, heating has to be stopped while welding is in progress. This may involve the welder stopping work to permit reheating and they suggest that a 20 min delay in every hour would be possible.

A solution the firm has developed is to use a range of heavy gauge nickel chrome elements in sintered alumina sleeves. Each element wraps round, once only, a particular diameter of the vessel to be heated. It is then enclosed in a hinged sheet metal case, suitably lined with lightweight thermal insulation.

The firm claim that fitting the heater on each side of a butt weld can be accomplished in five minutes, including connecting the heater to a welding set, which is used as a source of controlled power. Preheating time will take from 10 minutes to an hour, depending on the metal thickness and job diameter.

When the weld is completed, one of the heaters is brought to the centre of the weld and heat applied at the full heating rate. As an example, stress relieving temperatures of 600 to 650°C can be reached in 15 minutes on 6 in. diameter, ¼ in. thick pipes.

For a special job, such as the heat exchangers for a nuclear power station, the firm has used radiant heat obtained from twin 9 s.w.g. nickel chrome wires in hairpin formation carried inside 1¼ in. diameter sintered alumina sleeves. Each of these elements measured 4 in. wide by 7 ft long, and developed 1¼ kW per foot. The specification being met in this job was a 650°C hot zone for 9 in. over the weld, with a very gradual temperature gradient either side. Elements were mounted as rings inside the vessel. Bulkheads were fitted inside the vessel either side of the weld, and external heating coils placed round the weld area contained within a "hot box" arrangement. Using 120 kW balanced across the three phases of a 415 V supply, the necessary 650°C temperature was reached in six hours with 10°C peripheral uniformity.

New electric smelting service for industry

WHILE it is common practice for manufacturers to put research and development facilities which they have installed for their own use at the service of customers with problems of mutual interest, it is something new when a company invests its capital in a special laboratory with the prime object of inviting potential and existing customers to bring their problems for investigation.

Birlec-Efco (Melting) Ltd. are, therefore, to be commended in their new £50,000 enterprise, a pilot furnace installation which they have just opened at Aldridge, as a service for the use of metal smelters who are desirous of testing sample batches of ore and deciding on the best way of treating it.

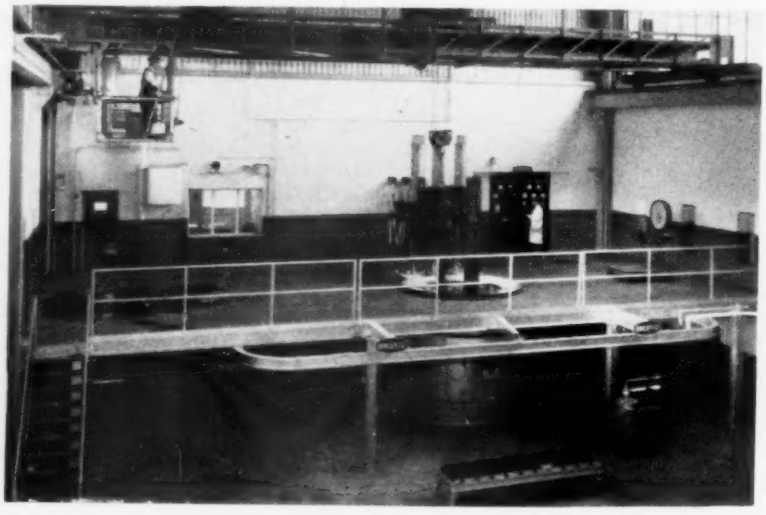
The furnace itself is 8 ft internal diameter with a nominal rating of 350 kVA and is provided with rotating or oscillating facilities at varying speeds. The charging platform is 9 ft from floor level and the furnace controls are conveniently located adjacent to the furnace. Below, three tap-holes are provided, the levels of which are adjustable for slag or metal, and a mono-rail supports the slag pots or metal ladles for transfer to the moulds. Thermocouples inserted into the refractory lining, monitor the temperatures at different points.

The furnace incorporates holders capable of accommodating up to 8 in. amorphous carbon or graphitic electrodes which are remotely controlled by pneumatically operated cylinders. Smaller electrodes and holders can be used when necessary.

Supply to the furnace is provided from a 350 kVA three-phase transformer, the secondary windings of which can be connected in series or parallel to give outputs at 250 to 130 volts or 125 to 65 volts, the series adjustment being in 20 volt steps and the parallel in 10 volt steps. A tapped reactor is also available for special work requiring a stable arc. Both reactor and transformer tappings are remote controlled from the control panel, but emergency hand tap-change is also provided.

The furnace is so designed that it can be operated as an open-top or closed furnace, the removable roof being raised or lowered by a 5 ton overhead crane.

Customers' materials will be accepted in trial batches for testing on a contract basis after which recommended production processes can be advised.



General view of new thermo-electric laboratories of Birlec-Efco

E.D.A. speaks on housing standards

LATEST electrical organisation to publish its evidence to the Government-sponsored investigation* of housing standards is EDA. The Association has presented a lengthy answer to questions posed by the sub-committee concerned, answers that may be compared with those given by the IEE (ELECTRICAL TIMES, 7 January).

As with other answers to the questionnaire, principal electrical interest attaches to the answer to the question, "electrical (lighting and power) points—please suggest what is the minimum scale of provision." The table lists the EDA suggestions, which align closely with those put forward by the IEE. However, these figures are preceded by a lengthy discussion of the whole question of adequacy. Results of inadequate provision of socket-outlets are seen both in complaints by housewives, and in accident returns. The evidence suggests that the difference in cost between an adequate electrical installation and that generally provided in flats and small houses today is less than 1½% of the total cost of the dwelling.

Results of Inadequacy

It is suggested that in nearly 60% of all dwellings today, there are no more than three socket-outlets. Limitations implied by such installations are not accepted by tenants, who attempt to connect whatever appliances they wish, leading to overloading of the wiring. The evidence continues with the statement that local authorities' experience shows that the cost of maintenance of electrical installations is inflated by misuse due to inadequacy.

In deciding what is an adequate installation, the range of appliances likely to be used must be considered. A list is given against each of the room recommendations, broadly the same as that advanced by the IEE.

Table 1. Recommended provision of socket-outlets

Hall or landing	1
Kitchen or utility room	6*
Living room	6
Double bedroom	5
Single bedroom	3

* Includes one in cooker control unit.

Thus for a five-roomed house, 26 socket-outlets are required; many can be twin socket-outlets, and all can be connected to a ring circuit. For a small house, only four circuits are required, one cooker circuit, one water heating circuit, one ring circuit, and one lighting circuit. The evidence notes EDA's opinion that the requirements set out "are reasonable, and that the facilities provided will be fully-used by the majority of occupiers." It also draws attention to the fact that later addition of socket-outlets is far more costly than the provision of a sufficient number during construction of the building.

* Investigation by a sub-committee on housing standards, of the Central Housing Advisory Committee of the Ministry of Housing and Local Government.

There are a number of answers on heating in the evidence. EDA sees the chief trend for home heating as towards a greater degree of comfort than is afforded by intermittent heating of one room in the home and towards clean and convenient methods. It suggests that if modern electrical methods are used, there is no reason why all new dwellings should not be provided with continuous background heating designed to take off the chill everywhere, and with supplementary heating to be used to bring any room up to the conditions required for relaxation as and when desired.

Heating Costs

In this respect, the advantages of floor-warming are advanced. With this system, it is suggested that electricity consumption for all purposes—heating, water heating, cooking, lighting, etc.—is from 7,200 to 10,000 units a year. The cost is put at from £28 to £52 a year.

It is not thought that any but houses for the higher income groups will have hot water radiators or ducted warm air supplies in every room; but it is argued that there is universal demand for heating to be made a possibility in every room.

Kitchen Planning

Great emphasis is placed on the need to plan kitchens and other rooms in a house so that there is convenience in storage of electrical appliances. A brief guide to kitchen planning is written into the evidence, with the emphasis on the minimum number of doors. With two doors, 120 sq ft is suggested as necessary; if there is only one door, 99 sq ft. It is suggested that where laundry appliances are concerned, socket-outlets should be provided for their use at least 6 ft from a sink. It is thought that with electrical equipment, kitchens can quite satisfactorily be used for laundry purposes, except in some three-storey terraced housing.

Condensation in kitchens is acknowledged as often a serious nuisance. It is remarked that with gas, there is about one pint of water present in products of combustion for every 40 cut ft burnt and over one gallon for every gallon of oil burnt. Electrical appliances do not present this problem.

In the kitchen and in other rooms, there is need for greater flexibility in use. For example, bedrooms should be capable of being used as studies or for recreational activities such as writing or painting. Design of these rooms should take this into account, and both space and sufficient socket-outlets should be provided.

The evidence comes down strongly against the idea of laundry facilities being provided in bathrooms rather than kitchens in flats. It is acknowledged that this is done on the Continent, but use of electrical equipment in such surroundings is strongly deprecated. The evidence adds that there seems little point in increasing the size of the bathroom when the appliances can be accommodated in kitchens if these are large enough.

OVERSEAS NEWS

from our correspondents abroad

CANADA

220 MW Set for Nuclear Station

A contract for a 220 MW turbo-generator for Canada's first major nuclear power station has been awarded to Associated Electrical Industries Turbine Generator Div. Value of the contract is about £2 million. Most of the work on the machine will be done in Britain, but certain parts will be made in Canada. The station is to be built at Douglas Point, on the eastern shore of Lake Huron. The turbo-generator is the largest so far ordered from a British manufacturer for a nuclear power station. AEI are also supplying the 20 MW turbo-generator for NPD2, the Canadian Nuclear Power Demonstration plant, 150 miles up the Ottawa River. The machine for Douglas Point will be a two-cylinder unit to run at 1,800 r.p.m. taking saturated steam with conditions at the t.s.v. of 565 p.s.i.g., 482°F. After expansion through h.p. stages, steam will be passed through water separators to a reheater, raising the temperature to 430°F, and thence to the three-flow l.p. section. The generator will incorporate water cooling of the stator windings, in conjunction with a hydrogen cooling system, and will be capable of operation as a synchronous condenser. Dr G. C. Laurence, director of reactor research and development Atomic Energy of Canada Ltd., recently stated that only quite large generating units would be competitive with coal-fired stations in the southern part of the country.

More Thermal Power?

The likelihood of the British Columbia Electric Co. establishing a steam power station, near Lilloet, some 180 miles north east of Vancouver, is heightened by the news that the company has purchased a coal deposit in the Hat Creek locality. Mining engineers have calculated that the coal deposits there are around 340 million ton in a square mile, with reserves about as much again. It is suggested that the BCE are proposing a steam station of about 2,000 MW, to utilise the deposits.

Columbia Talks

Although the Canada-US negotiations on the joint Columbia River development opened in Ottawa last week, it has been indicated that an early decision is very unlikely—in the US it is believed that it will be 1961 before the final deal is approved. One of the difficulties that has come to light is the attitude of some US Congressmen concerned in the proposed Libby dam project which seems to be squashed indirectly in the new arrangement. Some US observers are also perturbed at the outlook for Grand Coulee for which they consider the third power station might become uneconomic under the proposals, with a 50-50 division of output. Obviously there is a long way to go before some agreement can be reached.

Boost for Heating

Electrical heating is to be exlusively provided in about 1,500 homes under a new private building plan for the outskirts of Hamilton, Ontario. This will give the Hydro-Electric Commission's electric home heating scheme its biggest boost yet. The Commission had been aiming at 1,000 electrically heated homes by the end of this year, but if this new building plan gets started within two months, as it is hoped, that figure should be easily surpassed. The new building project is a completely self-contained development, including shopping centres, and underground wiring is to be adopted. There will also be a standby generating plant!

U.S.A.

Expenditure Planned

Supply authority spending in the USA for 1959, and plans for 1960, amount to $4,669 million and $4,900 million, respectively, according to a report in our US contemporary, *Electrical World*. The 1959 capital expenditure is put at generation, $2,369 million; transmission, $708 million; distribution, $1,413 million; and miscellaneous, 180 million; and that for 1960 as generation, $2,283 million; transmission, $813 million; distribution, $1,595 million; and miscellaneous, $209 million. If 1960 plans are carried through, expenditure for the current year will be 4·9% above that for 1959, and will almost match the record spending recorded in 1958. Split of spending between various types of supply authority who operate in the USA is given as follows for 1959: power companies, $3,383 million; municipal, state and power district systems, $781 million; co-operatives, $171 million; and federal agencies, $335 million.

Accompanying the survey is a statement on transmission and distribution construction that shows 10,573 circuit miles of transmission lines of 66 kV and above constructed during 1959 and 2,838 miles of lines from 22 kV up to 66 kV. Pole miles of primary distribution lines are estimated at 43,307 miles, of which 22,819 miles were rural construction. Some 343 miles of cable were connected into the transmission system, and 2,085 miles were used in distribution schemes.

ARGENTINE

Financial Relief?

It is reported that an Argentine Government economic team is studying the procedure to be followed for a re-negotiation of the contracts signed by the Agua y Energia Eléctrica Department with British Thomson Houston Co. and International Combustion Ltd., who in 1957 were awarded the contract to construct the 600 MW Dock Sud thermal power station. The contracts with both British firms total £25,600,000 and 1,050¼ million pesos, and involve a nine-year term for payment of the sterling expenditure. The Government's intention is said to be to secure longer terms in order to relieve the burden of commitments affecting the balance of payments in the years immediately ahead.

Cable Contract

A contract valued at US$14 million, is reported to have been signed by the Argentine Government and a consortium formed by Industrias Pirelli of Buenos Aires, Pirelli of Milan, Siemens Schuckert of Berlin, and Felten and Guillaume of Cologne, for the supply of 132 kV oil-filled cables. A transmission network is to be installed to distribute energy from the 600 MW Dock Sud power station in Buenos Aires. Pirelli of Milan will supply 67% of the cable called for in the contract.

HUNGARY

Start-up

The first 32 MW turbo-generator at the new power station at Pécs, in southern Hungary, is now feeding into the national grid system. Two more sets of similar size are to be added later this year, and ultimately the station will have a capacity of 220 MW. A "heating" turbine is also to be installed to supply steam heating to a new suburb housing 25,000 people.

ITALY

Increased Size

The nuclear power plant now being built for the SENN concern at Punta Garigliano, Italy, is to be expanded from 160 MW to 230 MW, we understand, in order to incorporate it in the Euratom-USA agreement. The power reactor for this plant is being built by the General Electric of America, with the aid of World Bank finance to the tune of about $40 million. It is suggested that with this increase in plant capacity, the station will be the largest in the world using a boiling reactor.

NIGERIA

Expansion Plan

A total of 32 towns in Western Nigeria are due to receive electrical power under the regional government's stepped-up electricity development scheme. The regional government, according to its Minister of Works and Transport, S. O. Sogbein, has provided an interest-free loan of £1·3 million to the Electricity Corporation of Nigeria for implementation of the plan.

SOUTH AFRICA

Mine Disaster Repercussions

After the numbing shock of the disaster at the Coalbrook North shaft of Clydesdale Collieries, near Coalbrook, Orange Free State, in which it now appears almost certain that 434 miners lost their lives, it is becoming possible to assess the extent of the results upon the supply of power from Taaibos and Highveld power stations, which have at present a total installed capacity of 720 MW, representing at least one-third of the output capability of the Rand and Orange Free State undertaking's system of the Electricity Supply Commission of South Africa. At the time production ceased at the North shaft, the average daily coal consumptions of the two power stations, which are fuelled by overland conveyor belts from the North and South Coalbrook shafts, were 6,000 ton and 2,500 ton daily at Taaibos and Highveld, respectively. As it had never been anticipated that a total shut down of a colliery could occur, at any rate for a protracted period, only elementary arrangements for receiving rail-borne coal had been made, and these only as an afterthought when it became desirable to use up the development coal from the South shaft which was sunk while Highveld was in course of erection. By strenuous efforts it has been possible to transfer just over 4,000 ton of coal per day from the South shaft conveyor belt, which normally feeds Highveld only, for use at Taaibos; unloading is the bottleneck as the transfer bunker has room for one hopper-bottom truck only. (The normal provision for rail-borne coal in South Africa at a station of the size of Taaibos would allow for unloading at least ten 50 ton hopper trucks simultaneously.) In the meantime, this rate of delivery has strained the resources of the South shaft mine, which has been unable to deliver the required 2,500 ton to Highveld simultanously, and stocks of coal at the latter station are falling. Meanwhile, emergency rail-borne coal unloading facilities are being constructed so that trucks of coal from other districts can be transferred to the colliery end of the Taaibos overland conveyor belt. It is not yet known how long will elapse before production can be resumed at the North shaft, but as access to a principal part of the workings has been cut off, perhaps irretrievably, and as mystery surrounds the causes of the disaster to the extent that the Department of Mines may be reluctant to grant permission to resume working until a full inquiry has been held, it appears that it may be necessary to rely on rail-borne coal at Taaibos for some time. The price by conveyor belt was about 8s per ton, but it is likely that rail deliveries will cost two or three times this amount. However, irrespective of fuel cost, it is essential to bring the station back to normal base load output capacity as soon as possible, since generating plant at other stations is being run to capacity.

PAKISTAN

Stopping Fraud

Theft of electricity is no new crime, but in some Eastern areas it has assumed large proportions. To combat the menace in West Pakistan, a special Detection Branch of the Water and Power Development Authority was established last June and has already shown worth-while returns for its efforts. During five months a total of Rs650,000 was recovered from consumers in Lahore alone. This is in addition to a saving of Rs150,000 per month resulting from consumers guilty of irregularities being brought to book and now paying their dues regularly. The Detection Branch is now extending its activities throughout West Pakistan.

AUSTRALIA

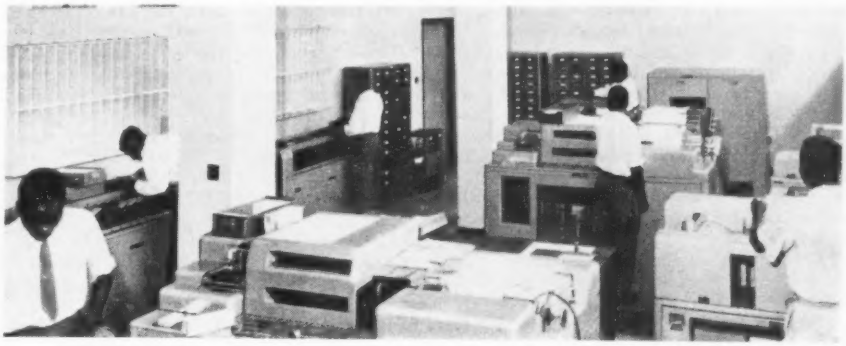
Load Control

The Electricity Trust of South Australia is considering the use of a ripple control system to replace the existing time switches in selected suburbs of Adelaide. These time switches have been used to control the loading of consumers' storage type water heaters for some years, but the advantages of centralised control are now being studied. Over 35,000 water heaters are now being served, compared with 4,214 ten years ago, and more effective control of the load is becoming necessary.

NEW ZEALAND

Fewer Undertakings?

Amalgamation of the existing 83 electricity supply undertakings in New Zealand into 23 power boards is the main recommendation of the Commission of Inquiry into the retail distribution of electricity, whose report has just been submitted to the NZ Government. The Commission suggest that these power boards would purchase bulk supplies from the NZ Electricity Department at a uniform charge, in much the same way as at present. The Commission was set up in February, 1959, with Sir Joseph Stanton as chairman, to consider a number of difficulties in connection with retail distribution of electricity, and public hearings took place at four centres. Their report is now being studied by the NZ Government, Mr Watt, Minister of Electricity, has announced, and is to be referred to Parliament in the coming session. The existing 83 electricity undertakings are made up by 43 power boards, 10 city councils, 21 borough councils, two town boards, four county councils and three companies. Some of the local authorities have, of course, utilised profits from their supply undertakings to aid the local rates, and in such circumstances they will probably be loathe to relinquish control.



Up to date in all its activities, the Uganda Electricity Board has installed a Hollerith accountancy system to deal with consumer billing, payment of wages, stores accounting and costing. Consumer billing for the whole area is centralised at head office, and some 28,000 accounts are issued monthly. Twelve of the fourteen members of the machine room staff, including the deputy supervisor, are Africans, some of whom, as short a time ago as one year, had not even seen a punched card installation

Personalities *in the industry*

Mr D. Spanton

Mr R. N. Millar

Mr S. W. Hutton

Mr L. C. Richards

Brig J. D. Haigh

In recent executive changes announced by Kelvinator Ltd., **Mr Duncan Welch,** hitherto domestic appliance sales manager, takes over from **Mr G. F. Eden** as executive director—sales. In this capacity, Mr Welch will be responsible for all sales and service in the UK and he joins the executive board. **Mr Derrick Spanton** has been appointed sales manager, domestic appliances, in place of Mr Welch and **Mr E. Dowsing** becomes contracts manager, domestic sales, responsible for main London stores accounts and central buying offices. **Mr G. F. Eden** has taken over the position of executive director—materials, with full responsibility for co-ordinating the procurement and movement of materials, an arrangement necessitated by the company's accelerated production programme.

Arising from the recent acquisition by Metal Industries Ltd., of Lancashire Dynamo Holdings Ltd., **Lt-Col G. S. Marston** has resigned as chairman, managing director and director of the latter company, but the **Earl of Halsbury** retains his office as vice chairman. The new chairman of Lancashire Dynamo is **Sir Charles Westlake,** with **Mr John Black** (also of MI) as deputy chairman.

Mr R. N. Millar, M.A., B.COM., M.I.MECH.E., M.I.E.E., a director of the General Electric Co. Ltd., has been appointed managing director of the company's Engineering Group which has its main works at Erith, Kent, and Witton, Birmingham. He will have overall responsibility for the whole of the company's activities in the heavy electrical, mechanical and nuclear engineering fields. A Londoner, Mr Millar was educated at Marlborough College and, after serving an engineering apprenticeship at the Fraser and Chalmers Engineering Works of the GEC, took his M.A. degree at Emmanuel College, Cambridge. After the war, during which he served in the Royal Navy as an engineer officer, he became an assistant mechanical engineer to the British General Electric Co. in South Africa where he took another degree in Economics and Industrial Administration. In 1952, he was appointed chief mechanical engineer to the BGEC in Sydney, Australia. Towards the end of 1954, Mr Millar was recalled to England to take charge of the company's atomic energy developments and later that year became manager of the GEC-Simon-Carves Atomic Energy Group. He was appointed general manager of Fraser and Chalmers Engineering Works, Erith, in 1958, and a year later became a director of the GEC. He has just recently returned from Japan where he signed a £20 million contract for the design and construction of a nuclear power station at Tokai-Mura, some 70 miles from Tokio.

Mr S. W. Hutton has resigned as sales director of Progress Cables and Accessories Co. Ltd., to take up an appointment with the Claremont Electrical Distributing Co. Ltd., as group export manager of the "CEDCO" group of companies.

Until recently chief engineer of Associated Electrical Industries' Transformer Division at Manchester, **Mr L. C. Richards,** B.SC.TECH., M.I.E.E., has become chief engineer to Heavy Electricals of India. He is seconded to this position from AEI Overseas, to whom he has been transferred. Heavy Electricals is the Indian Government company building the heavy electrical plant manufacturing centre at Bhopal. Following technical education at the Manchester College of Technology, Mr Richards joined the British Westinghouse Co. as a college apprentice in 1915 and obtained subsequent experience in the Transformer Sales Department. After war service in the RAF, he joined the Transformer Engineering staff, being responsible for the design of all types of power transformers, and in 1935 he took charge of the Projects and Tenders Section of the department; in this capacity he travelled extensively, visiting Finland, Holland other countries. In August, 1950, he became assistant chief engineer, Transformer Department, and was appointed chief engineer, Transformer Department in October, 1950. He became chief engineer to the Division on its formation in 1959. For many years Mr Richards has been interested in the national and international aspects of transformer development and has been closely associated with the work undertaken by Metropolitan-Vickers on behalf of BEAMA, BSI, and other organisations.

Brig J. D. Haigh, O.B.E., M.A., M.I.E.E., has been appointed Divisional Manager of the Capacitors and Resistors Division of the Plessey Co. Ltd. at Swindon. Brig Haigh was one of Britain's early radar experts and from 1939 until 1941 was a radar instructor at the School of Anti-Aircraft Artillery. In 1946, following intelligence duties in the UK and Far East, he joined the Ministry of Supply where, until 1950, he was responsible for the development of army radar equipment. In 1953, on his return to the UK from Singapore where he commanded an Air Formation Signals Regiment, he rejoined the Ministry of Supply and was appointed Director of Electronic Research and Development in the following year. He joined Plessey's in 1958.

The Royal Society has announced awards of grants by the Paul Instrument Fund Committee. Among these are: £545, in supplement of a previous grant, to **Dr R. Feinberg,** of the Electrical Engineering Department, Manchester College of Science and Technology, for the construction of an instrument for measuring the intensity of soft X-radiation generated in experimental high voltage valves; £3,000 to **Prof D. Gabor,** Professor of Applied Electron Physics at Imperial College, London and **Dr D. Jones,** of the Department of Electrical Engineering, Imperial College, London, for the development of an electron inter-

ference microscope; and £6,000 in supplement of a previous grant to **Dr C. N. Smyth,** of University College Hospital Medical School, London and **Mr F. Y. Poynton,** of Northampton College of Advanced Technology, London, for the construction of an ultrasonic microscope.

Mr John Guy has been appointed chief planning engineer of Measuring Instruments (Pullin) Ltd., succeeding **Mr D. Boothe,** who recently returned to Jamaica. Before his new appointment, Mr Guy was, for 13 years, with Sifam Electrical Instrument Co. Ltd.

Mr J. Laming has joined Southern Instruments Ltd. as export manager of the Data Handling and Recording Department.

Submarine Cables Ltd. announce the appointment of **Mr W. Sampson** as sales engineer and **Mr A. D. H. Milne-Home** as commercial manager, operating from the company's head office at Mercury Hse, Theobald's Rd, W.C.1. Mr Sampson, formerly transmission systems engineer with Standard Telephones and Cables Ltd., joined the Telcon organisation in 1953, transferring to the Repeater Division of Submarine Cables Ltd. in 1955. Mr Milne-Home joined the company in 1956 from the Royal Navy in which he served for 22 years and attained the rank of Lieut.-Commander.

Mr J. Baxter has been appointed field sales manager for the Scottish branch of Griffin and George Ltd.

Following a period of secondment to the organisation and methods section, **Mr H. E. F. Hodge,** A.M.I.E.E., has been appointed by the Eastern Electricity Board to be the district engineer at Stevenage in place of **Mr R. H. Worboys,** now Bedford district manager. (*ESH, page 104.) A Plymouth man, Mr Hodge received his technical training at the Royal Dockyard School for apprentices, following this by studies at the Plymouth and Devonport technical college. In 1946, on completion of his apprenticeship as an electrical fitter in the Devonport Dockyard, Mr Hodge entered the supply industry by joining the Plympton St. Mary Rural District Council electricity undertaking. After holding several engineering appointments with the South Western Electricity Board, Mr Hodge joined the planning staff of the Chilterns Sub-Area of the Eastern Board in 1954, and two years later he became the first assistant district engineer to the Bedford district. It was in 1959 that his secondment took place.

Suffolk Sub-Area accountant to the Eastern Electricity Board since March, 1949, **Mr A. H. Lewis,** M.I.M.T.A., A.S.A.A., has been appointed assistant chief accountant to the Board to fill a vacancy arising from recent changes in the chief accountant's dept. (*ESH, page 99.) Born in London in 1912, Mr Lewis was educated at the Coopers' Company's school, matriculating with distinction in mathematics, and his first employment was with the Stoke Newington Borough Council. In 1933 he transferred to the Shoreditch Borough Council. Then followed employment with the Weymouth, Luton and Rotherham Corporations where he held various auditing and accountancy posts. He joined the Ipswich Borough Council in 1945 and remained with that local authority until he joined the Eastern Electricity Board as an assistant accountant in the Suffolk Sub-Area in 1948.

Formerly head of the Naval design office of Evershed and Vignoles Ltd., **Mr E. R. Brooke,** M.I.E.E., A.M.I.E.D., is now acting as a consultant to several companies in the London area, specialising in the field of electro-mechanisms.

Formerly superintendent of the Distribution Division of the Trinidad and Tobago Electricity Commission, **Mr K. F. Seheult,** M.A.M.I.E.E., ASSOCIATE I.E.E., has been promoted to the new post of chief engineer to the Commission. He has served in the electricity supply industry for 32 years, starting with the old Trinidad Electric Co. in 1928. In view of Trinidad's rapidly expanding electricity industry certain organisational changes have been made. The post of assistant general manager has been abolished and the new post of chief engineer created to control the Commission's two engineering divisions responsible to the general manager for the generation and distribution of electricity in Trinidad and Tobago. **Mr L. G. Dookhie,** B.SC.(ENG.), A.C.G.I., A.M.I.E.E., has been appointed to succeed Mr Seheult as superintendent of the Distribution Division.

Owing to the unforunate recent death of Mr J. Kenyon, M.SC., Keith Blackman's chief electrical engineer for the last 13 years, **Mr H. W. Wright,** A.M.I.E.E., has been appointed head of the Electrical Department at the head office and works at Tottenham. Mr Wright has been with the company for 29 years.

Mr Frank N. Yates has been appointed commercial manager of Seton Creaghe Engineering Ltd., and will be responsible for the marketing of special equipment developed by the company for use over a wide field, including nuclear, electronic and chemical plant. After service with the radar development section of the Fleet Air Arm, Mr Yates spent five years as area manager in Manchester for Sunvic Controls, and during this time also worked closely with contractors on the instrumentation of the Berkeley power reactor. He helped to pioneer sales in Britain of data logging equipment. Mr Yates joined Seton Creaghe from Fisher and Porter, instrument manufacturers, of Workington, where he was sales manager. Also joining Seton Creaghe as technical sales representative is **Squadron Leader C. C. Caple,** after 32 years with the RAF as a technical officer.

The Electricity Council announce the appointment of **Mr James Dean,** F.C.C.S., A.M.B.I.M., as their district industrial relations officer in south west England. His new job covers the area of the South Western Electricity Board and of the South Western Division of the CEGB. (*ESH, pages 57 and 93.) From 1955 to 1959 he was secretary of the South Western and South Wales District Joint Advisory Councils of the Electricity Supply Industry. Mr Dean joined the Electricity Department of Birmingham Corporation in 1933, and during the war served as an officer in the RAF Home Command. On demobilisation, he returned to Birmingham and was appointed deputy training officer. After nationalisation in 1948, Mr Dean transferred to the Midlands Division of the Central Electricity Authority where he became education training and welfare officer. In 1950 he was appointed Divisional establishments officer until he went to the south west in 1955.

Two senior executives of AEI Sound Equipment Ltd. (formerly BTH Sound Equipment Ltd.), have been appointed executive directors of the company.

* *Denotes revision to the "Electricity Supply Handbook, 1959."*

Mr H. E. F. Hodge

Mr A. H. Lewis

Mr K. F. Seheult

Mr Frank N. Yates

Mr James Dean

They are **Mr R. Oulton,** who is now executive director and general manager, and **Mr A. P. Castellain,** B.SC.(ENG.), A.C.G.I., D.I.C., F.B.K.S., who is now executive director and chief engineer. Concurrently with these changes, **Mr E. V. Bowers,** M.B.E., formerly managing director of the company, has resigned from his executive duties to join AEI Lamp and Lighting Co. Ltd., but retains his directorship. Mr Oulton, who was educated at Manchester Grammar School, first joined BTH in 1921 at the Ladywood Ironworks, Hyde, Cheshire. Upon the closing down of the works he managed a local company, later joined a private limited company in London as secretary, in 1934 joined Sound Equipment Ltd. (later BTH Sound Equipment Ltd.), to which company he was appointed general manager in 1940, and acting secretary and general manager in 1956. Mr Castellain was educated at King's College Junior School, Wimbledon, and Eastbourne College, and received his technical training at the City and Guilds Engineering College, London. Between 1924 and 1929 Mr Castellain was a lecturer at Queen Mary College in communication engineering, and for a period was also a consultant to British Acoustic Films Ltd. He joined Sound Equipment Ltd., in 1930 and was its chief engineer until 1948 when he joined BTH at Rugby in charge of sound reproducer sales; from 1941 to 1946 he was seconded to BTH Rugby for development work on 3 cm radar. He returned to London in 1956 as chief engineer, BTH Sound Equipment Ltd.

Mr Derek Last and **Mr Kenneth Last** have been appointed to the board of directors of SLR Electric Ltd.

Formerly principal assistant in the Accountancy Department of the Southern Division, CEGB, at Portsmouth, **Mr J. Lappin,** F.C.A., F.S.S., is off to Ghana this week to become chief accountant in the Ghana Electricity Department. The appointment, nominally for a period of three years, results from a recent survey of the organisation and operation of Ghana's Electricity Department.

Concerning our note last week on the reorganisation of the AEI Plant Applications Engineering Department, we should make it clear that **Mr P. E. Peck** and **Mr J. McTaggart** are located at Rugby, but **Mr L. Abram** and **Mr H. Williams** are located at Manchester, and have also the title of assistant manager on account of administrative duties.

Since its formation in July, 1958, the Turbine-Generator Division of Associated Electrical Industries Ltd. has made various appointments on the engineering side of its organisation, and the more recent of these can be summarised as follows: *Large Steam Turbine Department:* **Mr J. S. Hall,** B.SC.(TECH.), A.M.I.MECH.E., chief engineer; **Mr J. C. London,** B.SC., assistant chief engineer (development). *Small Steam Turbine Department:* **Mr P. D. Morris,** M.I.MECH.E., chief engineer (direct coupled sets); **Mr F. D. Roberts,** ASSOC.M.C.T., chief engineer (geared sets). *Gas Turbine Department:* **Mr F. R. Harris,** B.SC.(ENG.), A.M.I.MECH.E., chief engineer; **Mr H. Farrington,** A.M.I.MECH.E., assistant chief engineer. *Mechanical Engineering Development Department* (under Dr D. M. Smith, chief engineer): **Dr K. W. Todd,** D.ENG., M.I.MECH.E., A.F.R.Ae.S., assistant chief engineer (fluid and heat flow); **Mr H. B. Svendsen,** DIPL.MASCH.ING.E.T.H., M.N.I.F., assistant chief engineer (mechanical). *Nuclear Auxiliaries Department:* **Mr T. E. Adams,** B.SC.(ENG.), chief engineer. *Turbo-Generator Department:* **Mr H. I. Wood,** B.SC., A.M.I.E.E., chief engineer (large machines); **Mr F. R. L. Creek,** B.SC.(TECH.), A.M.I.E.E., assistant chief engineer (large machines); and **Mr J. Scott,** B.SC.(HONS.), chief engineer (medium machines).

OBITUARY

Mr F. P. Spicer, M.I.E.E., formerly manager of the Engineering Department of the Pyrene Co. Ltd., died on 9 Feb., aged 80.

Mr E. A. Roden, formerly a director of Kelvinator Ltd., with whom he served for 30 years, died recently.

Mr T. E. Alger, A.M.I.E.E., who was president of the Electrical Contractors' Association and associated organisations, died on 11 Feb., aged 87. He was the only surviving son of the late Mr Rowland Alger who founded the well-known Newport (Mon.) electrical contracting firm of R. Alger and Sons. He joined the family business in 1898, and subsequently founded Alger's Wholesale Supplies. Mr T. E. Alger's year of office as president of the ECA coincided with the first of the association's annual conferences. He was also a past-chairman of the IEE Western Centre.

Mr E. C. Spray, of Whitstable, a retired electrical contractor, died on 13 Feb., aged 84.

Mr C. J. Greene, formerly of Callender's Cable and Construction Co. Ltd., died on 9 Feb., aged 82.

NEW LITERATURE

Electron Switching, Timing and Pulse Circuits

by Joseph M. Pettit, PH.D.

ELECTRONIC generators can broadly be divided into two main groups; those for the generation of waveforms which are sinusoidal or nearly so, and those for the generation of "pulses" of square or peak shape separated by intervals of zero voltage. It is convenient to group the former together as "oscillators" and the latter as "switches" or "gates." Each group can further be subdivided into generators using thermionic valves and those using the relatively new semiconductor devices.

Previously it has been a common practice to break the subject of circuits vertically, as it were, into thermionic and semiconductor classifications. Here the author takes the step of dividing the subject into two "horizontal" classifications and confines himself to those circuits employing valves or semiconductors as switches or gates.

By this approach he leads the student confidently into a physical understanding of the various techniques for the production of pulse circuits and their integration into television, radar, telecommunication, computer and similar circuits. It has the coverage of material used for the training of electronic engineers at Stanford University for the last ten years, but is up to the moment in that it describes circuits of such recent date as the Sanatron, Phantastron, etc. Published by McGraw-Hill, 260 pages, 9 in. by 5½ in. Price 58s.

Compression and Transfer Moulding of Plastics

by J. Butler, A.M.I.MECH.E., F.P.I.

THE designer of a plastics mould, an expensive item in any circumstances, must have rather more than a knowledge of the elements of die design; he must know, with the instinctive feel that only experience can bring, all of the factors which will affect the production of the finished moulding and must make his choice of process, designing his die to suit, check the first mouldings and make such modifications as may be required before releasing the die for production. No matter how long his experience it is almost certain that some modifications may have to be made.

The author, now with British Industrial Plastics, has here recorded the fruits of more than 30 years' practical experience in compression and transfer mould design in which, as he says, "he can claim to have made as many mistakes as anyone in the industry." Such knowledge is invaluable to the designer, whether he be experienced or only just beginning.

To the small engineer, a scrapped die can mean disaster—it has broken more than one toolmaking business—and though a knowledge of the contents of this book will not entirely remove that risk, it will materially lessen it. Published by Iliffe and Sons, 223 pages, 8½ in. by 5½ in. Price 35s.

BOOKS RECEIVED

Electrical Circuit Analysis, by K. Stephen. Text-book for general degree studies with accent on basic equations for circuits. Published by Cleaver Hume Press Ltd., 259 pages, 8½ in. by 5½ in. Price 30s.

Public Enterprise in Britain, by V. V. Ramanadham. Discusses problems associated with nationalisation in fields of management, pricing, resource allocation and public control. Published by Frank Cass and Co. Ltd., 176 pages, 8½ in. by 5½ in. Price 21s.

Value Engineering, 1959. Papers presented to US Electronic Industry's Association conference, relating to overall cost reduction. Published by Engineering Publishers, Elizabeth, New Jersey, 165 pages, 9 in. by 5½ in. Price 6$.

Eliminating installation faults by instruction

PART 2—by E. J. Sutton,* M.I.E.E.

TEACHERS in technical colleges do much to improve standards of installation work through instruction in practical realisation of the requirements of the IEE Wiring Regulations. The faults most commonly found by inspecting engineers need particular attention during instruction on practical work. Part 1 of this article reviewed common faults falling under Regulations 101 to 208. The present part concludes this review.

Regulation 209—Protection against mechanical damage. The first sentence of sub-clause (A) is well worth quoting in full :

> "All cables shall be adequately protected against any risk of mechanical damage to which, having regard to the nature of their covering, they may be liable in normal conditions of service."

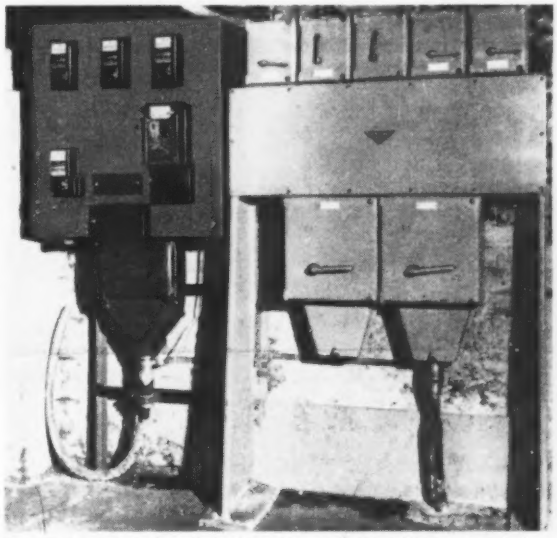
Too often there is a temptation to install sheathed wiring systems in haphazard fashion in the roofs of domestic premises. Sometimes these roof voids are used for storage purposes and frequently the cold water tank that is sometimes fixed in the roof may need attention. Apart from tripping up the unwary householder, the cables may suffer damage if straggled across the joists or run along the top of them. Fig. 11 gives a good example of sheathed wiring properly installed. It will be noted that the cables are adequately clipped along the sides of the roof joists and are therefore out of harm's way.

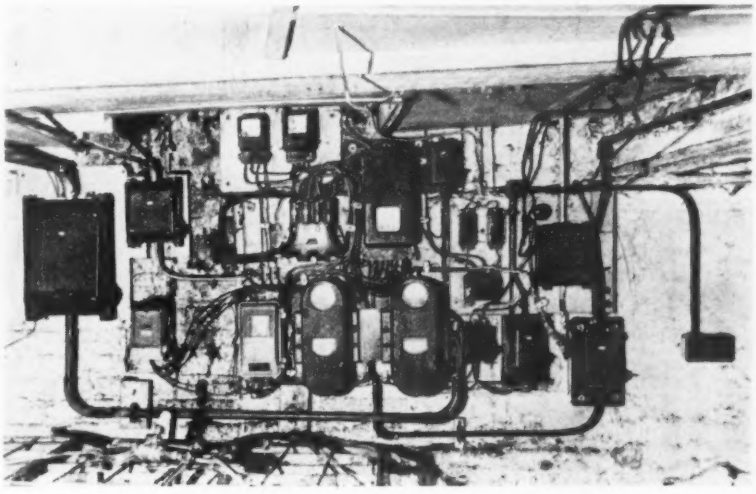
Sub-clause (F) of Regulation 209 is also worthy of special mention as this applies particularly to meter positions at the consumer's terminals. Fig. 9 is an example of these positions only too often met with on existing installations. Fig. 8 is another ghastly example which, after being stripped out entirely, was replaced by the much more compact and sound engineering job shown in Fig.7.

Regulation 210—Supports for cables. Since sheathed wiring systems are in such common use, sub-clause (B) of this Regulation is of particular importance in practical instruction classes.

Mention has already been made of the temptation to "throw in" the wiring in the roof void and another look at Fig. 11 will show how this Regulation has been properly observed.

Regulation 211 — Protection of cables against damage by heat. Again referring to the use of sheathed wiring systems for domestic installations, special care must be taken when polythene-insulated cables, usually sheathed with p.v.c., are used to connect to ceiling mounted fittings or direct mounted batten lampholders. Although when erected, a 60 watt or lower wattage lamp may be used, it should be borne in mind that the householder may subsequently put in a lamp of much higher wattage. The heat generated by the higher wattage lamps may easily cause damage to the polythene-insulation and at all such positions, protective heat-resistant sleeving should be placed over the polythene insulated cable cores. Reference should be made particularly to sub-clauses (A) and (B) and to Table D, to obtain the maximum operating air temperatures under which various types of cables may be installed.





Figs. 7 (above) and 8 (below). The untidy installation seen below offending Regulation 209F, was replaced by the far preferable engineering job seen above

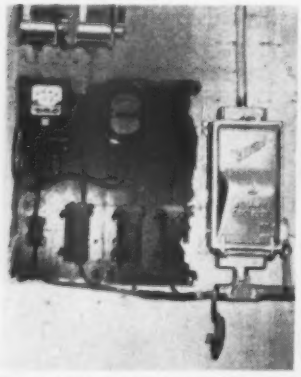
* Mr Sutton is Chief Technical Officer, NICEIC. Part 1 of this article began on p. 201, 11 Feb. issue.

The same Regulation also requires that special precautions shall be observed where connections are taken to equipment or appliances such as immersion heaters, thermal storage block heaters and other fixed or free-standing heating appliances, where the operating temperature conditions may require that special heat-resistant cable connections be used. Fig. 10 shows an example of the wrong use of sheathed wiring connections straight into the immersion heater head. Such cables will not indefinitely withstand the operating temperature conditions.

Regulation 214—Segregation of services. Whilst sub-clause (A) may be fairly easily understood, there is sometimes a doubt as to the correct interpretation of sub-clause (B).

Briefly, this part of the Regulation requires that, where the conduit, metal sheathing or armouring of the cable, or earth continuity conductor, cannot be prevented from coming into contact with any part of any other wiring system, or with the metal pipes of other services such as gas or water, or with structural steelwork, then such conduit, metal sheathing, armouring, or earth continuity conductor, must be bonded solidly to the external metalwork of the other system.

Reference again to Fig. 10 will show a typical instance where this bonding is required. The earth continuity conductor is taken into the immersion heater head and is therefore in contact with the metal cylinder. Unless a test shows that there is negligible resistance at the joints between the immersion heater head and the metal cylinder, and between the metal cylinder and the incoming and outgoing water service pipes, then the earth continuity conductor, the cylinder and the incoming and outgoing pipework must be connected together by means of a bonding conductor.



Figs. 9 (left) and 10. On the left is seen an example of an unsatisfactory intake arrangement. The immersion heater connections on the right illustrates a wrong use of sheathed wiring in a position of extra heating; and also shows when bonding to water pipes is required

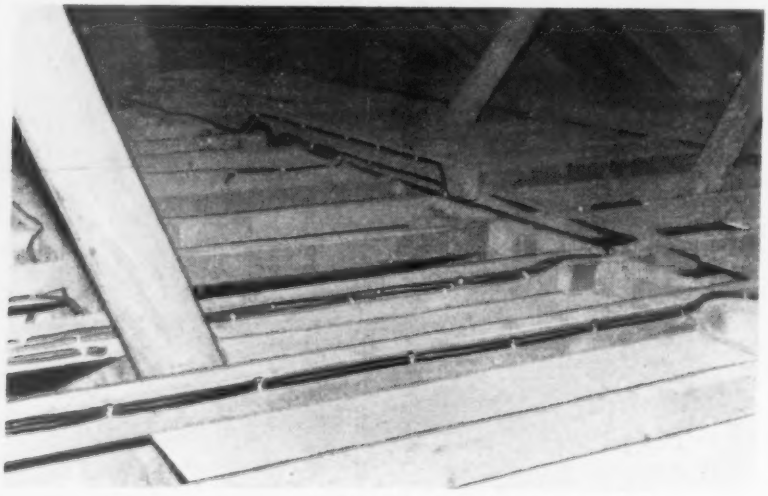


Fig. 11. A well-executed installation of sheathed wiring in a roof void

Regulation 218—Conduit systems. This Regulation is concerned mainly with the practical installation of conduit and is one of the Regulations that must be fully understood by the student early in his practical training.

Although it is an elementary requirement that the ends of all conduits shall be cleaned and all internal burrs removed, it is sometimes not always fully understood that some form of bushing of the end of the conduit should at all times be provided. This applies at tapped entries to boxes other than those provided with a spout entry.

It is important, too, to remember that all positions at which the cables are drawn into the conduit system, i.e., at outlet positions, inspection boxes, draw-in boxes, etc., shall remain accessible during the life of the installation (see note to Regulation 218A).

Regulation 219—Special requirements for metal conduit systems. The continuity throughout the whole of the conduit installation is of the utmost importance, so as to ensure that the fuses or other protective devices operate effectively under fault conditions. Loose conduit threads, slack bushes, locknuts or other connections can give rise to high-resistance joints in the conduit system, unless care is taken to ensure that they are thoroughly tightened during the erection period. Any conduit threads left exposed after tightening up locknuts must, of course, be painted as protection against rust.

Regulation 222—Special requirements for flexible conduit systems. There have been serious consequences resulting from the lack of proper bonding where flexible metallic conduit is used for connections between the rigid conduit system and any piece of equipment or apparatus which may be subject to movement. A separate earth continuity conductor must be installed and reliance cannot be placed on the flexible conduit, as this may fracture at the point of entry to the terminating adaptor or gland. The minimum size of earth continuity conductor must be 7/·029 (see Regulation 407B(iii) and Table 4). Although it is common practice to install this earth continuity conductor outside the flexible metallic conduit, it is permissible to enclose it with the other cables, providing proper means are available for securely bonding the earth continuity conductor at each end of the flexible conduit run.

Regulation 223—Special requirements for duct and trunking systems. Whilst the general requirements for duct and trunking systems are very similar to those laid down for conduit installations, particular attention should be paid to sub-clause (G), dealing with the space factor of number of cables that may be installed in such systems. Any overcrowding of cables within trunking may lead to serious overheating and this is particularly important on installations feeding fixed heating loads, where there is no diversity factor on the final sub-circuit wiring, and the connected load is taking maximum current for long periods.

Regulation 226—Special requirements for flexible cables and flexible cords. Most faults found on installation come within sub-clause (C) of this Regulation, where the wrong type of cable or cord has been used for a particular purpose. This applies mainly in bathrooms and kitchens where condensation may be present and where braided and twisted flexible cords should not be used, but circular tough rubber- or p.v.c.-sheathed flexible cable.

General Considerations

So far only Sections 1 and 2 of the IEE Wiring Regulations have been commented upon as regards common faults that occur in electrical installation work. There are, of course, other common faults that occur in the Regulations contained within the other sections, some of which have been included in the Council's leaflet "Common Installation Faults." Some other suitable occasion may perhaps be found for further explanatory comments to be made on these sections.

It is important that the instructor bears in mind at all times the note to the heading to Part 1 of the Regulations—"Good workmanship is essential for compliance with these Regulations."

Although the Regulations set forth minimum requirements for safety from fire and shock, they are nevertheless "minimum requirements," and reference should be made to the Electrical Codes of Practice (detailed in Appendix C, page 147, of the 13th Edition with 1958 Amendments), for the appropriate preferred practice for a particular type of electrical installation. The two Codes which form an essential part of the instructor's and the pupils' works of reference are :

C.P.321—Electrical Installations—General and C.P.325—Farm and Horticultural Electrical Installations.

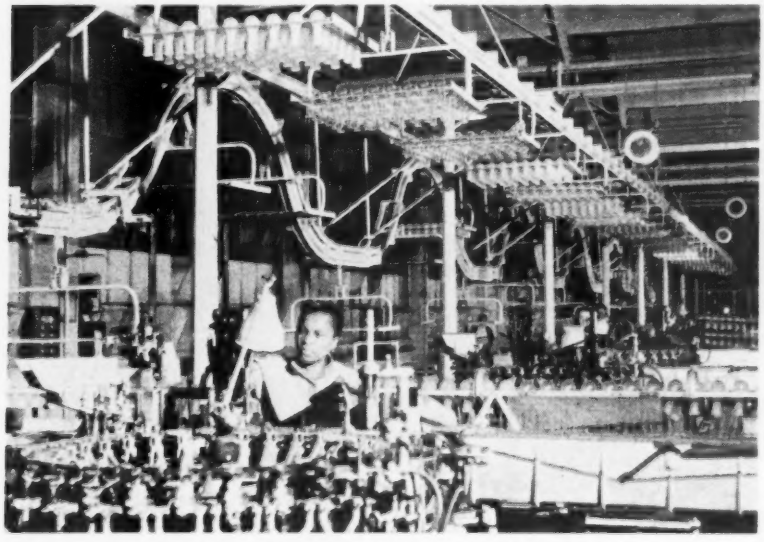
Reference has been made to what has already been done by the Ministry of Education, with the co-operation of the National Inspection Council, and many inquiries have been received from technical colleges and other teaching establishments, for further copies of the "Common Installation Faults" pamphlet. Copies of this pamphlet may be obtained by any of these establishments upon application by the principal, head of department or bona fide instructor, to the National Inspection Council for Electrical Installation Contracting, Aldine House, 10/13 Bedford Street, London, W.C.2.

In addition, a limited supply is available of copies of the paper given at the British Electrical Power Convention at Torquay in June, 1959, which sets out the objects and organisation of the National Inspection Council and contains other information of use to instructors in electrical installation work. The paper is complete with the discussion and the replies thereto, and copies may be obtained, so long as stocks permit, upon application as described above.

(Concluded)

Automatic conveyor for lamp bulbs

IN the manufacture of tungsten filament lamps an important factor is the conveying of the bulbs from the receiving bays, through the washing and stamping plants to the lamp-making machines. Where, as is usually the case, a large number of machines have to be supplied, holdups in the delivery rate to any one machine line can cause serious loss of production. Conversely, accumulation of washed and stamped bulbs awaiting delivery to the machines can result in inferior lamp production through condensation and dust accumulations after washing. A regulated flow is, therefore, essential and, at the Osram Lamp Works of the GEC at Wembley, a new conveyor system has just been installed to carry some 20,000 lamp bulbs per hour from the ground to the top floor, where the lamps are made, and to deliver them, hot and clean, at the required rate to ten production groups of machines.



Lamp bulbs on their trays arriving at the production lines on the top floor of the Osram lamp works at Wembley. This new conveyor system transports up to 20,000 bulbs per hour from the reception bays on the ground floor to the lamp making machines above

By routeing the conveyors overhead as much as possible, valuable floor space is saved and breakages are reduced. On the lower floor the glass bulbs are unpacked, inspected and loaded into trays. This is the last time they will be handled until the finished lamp is delivered from the production lines. The trays are placed on sloping ramps, of which there are ten corresponding to the machine groups on the production floor, and the conveyor hangers pick up one tray at a time from each ramp and transport it to the appropriate production group, collecting an empty tray in exchange. Should the group not be ready to accept the tray, it is recirculated until required. On the production line the lamp bulbs are automatically washed, dried by hot air, stamped and passed to the lamp making machine. The conveyor system is designed to feed the bulbs at a slightly greater rate than required so that the lamp-making machines are never at a standstill for need of glass bulbs.

This is just one more stage of mechanisation in lamp making which has been introduced by the GEC to improve the output and quality of Osram lamps.

for the electrical trade

Continental refrigerators

ANOTHER range of refrigerators from the continent is now available in Britain. This is the "General," from Italy, and it covers four models with capacities from 5 to 9 cu ft. Tall and slim-looking, these cabinets are designed to combine maximum storage capacity with economy of floor space.

The models range from 21 in. to 24 in. in width and from 47 in. to 56 in. in height. These sleek proportions are accentuated by bold straight-edged design. The interiors are in pastel blue or green and are fitted with open grid racks of polystyrene, in the smallest model, or metal in the remainder, to give free circulation and easy viewing of the contents. Door shelf space has been utilised to the utmost with ample accommodation for bottles.

A feature of all models in this range is a semi-automatic de-frosting control. Depression of a button in the centre of the temperature controller suspends the freezing process for long enough to allow full de-frosting. Normal operation is resumed automatically.

The makers claim that the "General" is particularly suitable for use in tropical climates. The walls are insulated with fibreglass and even the smallest air spaces between the panels positively sealed.

An American sealed unit with full width aluminium evaporator is incorporated. Refrigerator units and thermostats are guaranteed for five years, servicing being provided by Home Maintenance Ltd. Capacities and prices are:

Model		*Price*
B180	N—6½ cu ft	£89 5s
C170	L—5 cu ft	£78 15s
B180	LP—7 cu ft	£102 18s
B250	LP—9 cu ft	£126 0s

General Refrigeration Ltd., 39 Beak St, W.1.

The C170 L "General" refrigerator with a capacity of 5 cu ft. Price £78 15s

Noiseless drill

THE Revo "Jobber," a quiet electrical drill with a built-in spirit level, will soon be available in the south of England. When we mentioned the drill in an earlier issue (5 Nov., 1959) it was being sold only in the Midlands, but from March, it will be obtainable in East Anglia, London and the Southern Counties. Readers may remember that this appliance can be supplied with a full range of accessories available in 18 separately priced packs, the whole selling at £45 2s 2d complete. The drill alone costs £8 18s 6d. *Revo Electric Co. Ltd., Tipton, Staffs.*

TRADE PUBLICATIONS

ARROW.—52-page catalogue (M.S.11) on motor control gear from Arrow Electric Switches, Hanger La, London W.3.

AUSWALITE.—Folder with loose leaf enclosures on illuminated letter signs, "Perspex" sinks, low-voltage lighting units, "Auswal" adjustable pallet racking, from Austin Walters & Son Ltd., Ayres Rd, Manchester 16.

BENHAM.—Loose-leaf folder with 20 leaflets on electrically heated cooking apparatus for catering purposes from Benham & Sons Ltd., 66 Wigmore St, London W.1.

E.M.B.—12-page catalogue on die-casting machines (M.384) from E.M.B., Co. Ltd., West Bromwich.

ESCORT.—20-page catalogue (4231-71) on "Escort" marine radar from A.E.I. Ltd., Electronic Apparatus Division, Leicester.

FALKS.—20-page catalogue (No. 818) on outdoor lanterns, four-page leaflet on Parabeme/Colorbeme spotlights (P.2757) and leaflet on "Filtrair" shades (P.2754/59) from Falk Stadelmann and Co., 91 Farringdon Rd, London E.C.1.

FIELD.—Four-page leaflet on fluorescent lighting ballast units with cast resin impregnation from H. W. Field and Son Ltd., Harold Wood, Essex.

GLENCRESTON.—Four-page mailsheet for February detailing corrosion resistant non-metal pumps up to 15¾ g.p.m. without or 14¼ g.p.m. with suction lift, from Glencreston Ltd., 41 Church Rd, Stanmore, Middlesex.

HYDEX.—Leaflet on Hydex protective clothing from Jeltek Ltd., Green La, Hounslow, Middlesex.

LANCASHIRE DYNAMO.—Descriptive brochure (ML.88) on motors for cranes, hoists and lifts from Lancashire Dynamo and Crypto Ltd., Trafford Park, Manchester.

Travelling iron

THE Metway range of electric irons has recently been extended to include a neat travelling iron. The "Dualway," designed for use on a wide range of voltages, is supplied complete with a tartan zip case

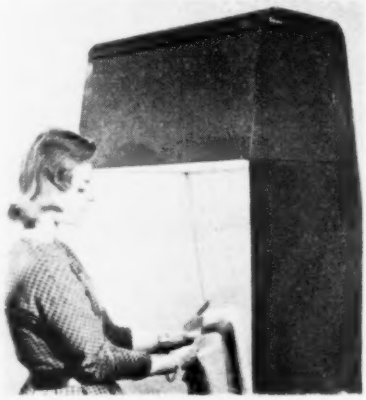
The soleplate is of stainless steel (an unusual feature for an iron of this type) and is heated from two separate elements. These elements are so positioned that the whole of the plate is heated whatever voltage is employed. The iron will, in fact, run on all voltages between 100 V and 250 V, 250 W. It is light and and compact with a chromium plated cover and folding handle. The price, which includes the tartan case, is £3 4s 6d. *Metway Electrical Industries Ltd., Canning St, Brighton 7.*

Colour matching unit

A NEW version of the colour matching light source which has proved a vital instrument to textile, paint and colour printing industries, has recently been released by the Lamps and Lighting Dept., of the AEI. This unit, the F221/43, is a low-cost appliance incorporating two 2 ft 40 W special fluorescent tubes and two 60 W single coil tungsten filament lamps, the latter providing colour correction at the red end of the spectrum. The overall light output has been adjusted to give a spectral quality at a colour temperature of 6,500-7,000°K which is comparable to natural daylight from the north sky.

The control switch has a third position which allows the tungsten filament lamps to function alone. With this control the user can compare the effects of daylight and artificial light upon the colours under scrutiny.

The diffusing window aperture is 23¾ in. by 17 in. Overall dimensions of the unit are 24½ in. long by 18¼ in. deep by 14½ in. high. The weight is 30 lb and the unit is designed for operation on 200-250 V a.c. supplies. The price, £25, includes purchase tax on the lamps which are supplied with the unit ready for use. A stand is also available at £4 4s. *A.E.I. (Woolwich) Ltd., Lamps and Lighting Dept., 155 Charing Cross Rd, W.C.2.*



A new colour matching unit from AEI, the F221/43. Price £25

equipment for industry

Timers, gentlemen—please!

A FAMILIAR cry, always urgent, but even more so when production is being held up by a failure in an important timing or control gear mechanism. Anxious to assist their customers when such a predicament occurs, a company has recently established a quick delivery service for timing and control equipment to meet a variety of requirements. Stocks of assemblies and sub assemblies from a number of manufacturers' ranges are stocked and are ready to be built up to individual needs by a reserved skilled staff. Stocks are based on the automatic and semi-automatic timers made by Electrical Remote Control Co. Ltd., and even equipment for relatively complicated controllers can be assembled, designed and dispatched in a few days. Although it will be necessary to increase the price of quick-delivery timers to meet higher overheads and factory costs, it is felt that this will be more than justified by savings in production time. *Equipment and Services Ltd., Bush Fair, Harlow, Essex.*

Plastics pipe support

A SIMPLE quick and neat way to attach pipes to walls or ceilings is to use the "Maclow Thermoplastic Holderband" illustrated below. It is made of thermoplastics material sufficiently flexible to allow the pipe to be sprung into position in the holder. The pipe is then retained by a plastics cap screwed onto a split thread. The holder is held to the wall by a screw and is available in a range of sizes suitable for pipes from ¼ in. to 3 in. dia. The holder is suitable for electrical conduit and cables and can also be used with either metal or plastics piping provided their working temperature is not excessive. An important feature of the Holderband is its acid-resistant and non-corrosive properties. *K.W. Chemicals Ltd., Caroline Hse, 55/7 High Holborn, W.C.1.*

Light beam fire alarm

AN unusual method of detecting an outbreak of fire depends on interruption of a light beam by smoke. The detector uses two light beams which fall on separate photoelectric cells. If one of the beams is interrupted or reduced in intensity by the presence of smoke, the output from the two photo cells becomes unbalanced, and a warning is given. It is claimed that the system is unaffected by general changes in ambient light and is also insensitive to fog. The light beams are projected across the space just below roof level and it is claimed that the system gives large coverage with reliability. *Photoelectronics (M.O.M.) Ltd., Oldfields Trading Estate, Oldfields Rd, Sutton, Surrey.*

Miniature potentiometers

TO meet the increasing demand for small components, a range of potentiometers has been designed with maximum resistances varying from 1 k ohm to 2·5 M ohm, yet only ½ in. overall diameter. The potentiometers are spindle operated and housed in an aluminium case. A moulded carbon resistive outer track is bridged to a silvered inner conducting track through a special brush assembly claimed to have unique features and said to give greater reliability than conventional arrangements. Type L potentiometers are suitable for a temperature range from −55 to +85°C and for voltages below 350 V.

The same company have augmented their range of moulded track potentiometers by a hermetically sealed version suitable for ambient temperatures from −40 to +70°C. The spindle is sealed by neoprene rings and connections are brought through ceramic seals. The potentiometers range from 500 ohm to 2·5 M ohm. *The Plessey Co Ltd., Ilford, Essex.*

Inverters use transistors

A RANGE of transistorised inverters has been developed, said to give a pure waveform at high efficiency and also suitable for generating square waves or high voltage d.c. The inverters could be used instead of rotary converters or vibrator inverters. It is expected that the range will be extended as higher power transistors become available. *Elliot Automation Ltd., 34 Portland Pl, W.1.*

Press-to-test lamps

IT is not always practicable to arrange lamp warning circuits to fail to safety. For those situations where a lamp must light to give warning, some quick method of checking its filament is important. A range of small warning lamps, recently introduced, can be checked merely by pressing the plastics lens cover. The lamps are intended for industrial and aircraft applications and in addition to the test feature can be supplied with a dimming lens shutter enabling brightness to be controlled in accordance with ambient light intensity. The lamps are suitable for 6, 12 or 28 V working and consume 1 W. They measure only 1⅛ in. long and can be mounted at ⅞ in. centres. Lamps are available with four colour, or clear lenses and are provided with rubber cable covers and internal seals to reduced moisture and dirt ingress. The rubber seal has cable holes for access to the three screw type terminals, but crimped terminals can also be used. The lamps can be safely used in ambient temperatures up to 50°C. *Dowty Nucleonics Ltd., Aircraft Electronics Div., Tewkesbury, Glos.*

The Maclow Thermoplastics Holderband provides an ideal means of supporting conduit and piping. The holderbands are made from polypropylene and are suitable for use at temperatures below 160°F

Plessey miniature potentiometer. A special brush design, used to connect the moulded carbon resistive track to a silvered contact track, is claimed to give high reliability

Dowty warning lamp can be supplied in several colours and with an adjustable light filter. The filament can be checked by pressing the lens cover

Smarter asbestos

AN aluminium metallic layer, resin bonded to asbestos cloth, not only imparts a smart decorative appearance, but also aids fuel economy because of the extremely high heat reflection achieved. Aluminised asbestos cloth is available in five qualities suitable for direct application to pipes or alternatively over primary lagging. It is also rotproof, and water, oil and vapour resistant. *Turner Bros. Asbestos Co. Ltd., Rochdale.*

Small hysteresis motor

A SMALL, but powerful hysteresis motor has recently been announced. The motor has a mechanical output of 8 W, but measures only $1\frac{1}{16}$ in. diameter. It is suitable for either 200 or 115 V 400 c/s supplies and a further version is being developed for 50 c/s supplies. The motor, which could be used for blower drives in electronic equipment or for tape recorders, will start under full load, and is synchronous in operation. Three-phase four pole, and two-phase six pole, versions are available. *Smiths Aviation Division, Livingstone College, Leyton, E.10.*

Glass laminates

LAMINATES woven from glass filaments comprise the Vitrotex products range in thickness from 0·008 in. to 2 in. The laminates are available with phenolic, melamine and silicone resins, the latter being suitable for use at temperatures up to 250°C. Typical electrical strength for the silicone resin laminates is 250 V/mil for a $\frac{1}{16}$ in. thick specimen measured normal to the laminae. The laminates have good mechanical and chemical properties, and can be supplied either in sheet form or already machined to customer's requirements. The company also manufacture a wide range of Phenotex fabric laminates and bearings in the same material. *J. Burns Ltd., Wangye Wks, Chadwell Heath, Essex.*

Better and cheaper pumping

IMPROVED pump design has enabled prices of a new range of Sumo pumps to be reduced even though they include the more costly Clam Sealed driving motors. The Short Four range is available in three sizes. The pumps now incorporate sand slinger vanes and enable a higher head per stage to be obtained than on previous models. The Clam Seal motor, now available in single- or three-phase designs up to $\frac{1}{2}$ h.p. has the advantage over the earlier water sealed design of permitting operation in sand laden water. *Stone-Chance Ltd., 28 St. James's Sq, S.W.1.*

Protection for watchmen and premises

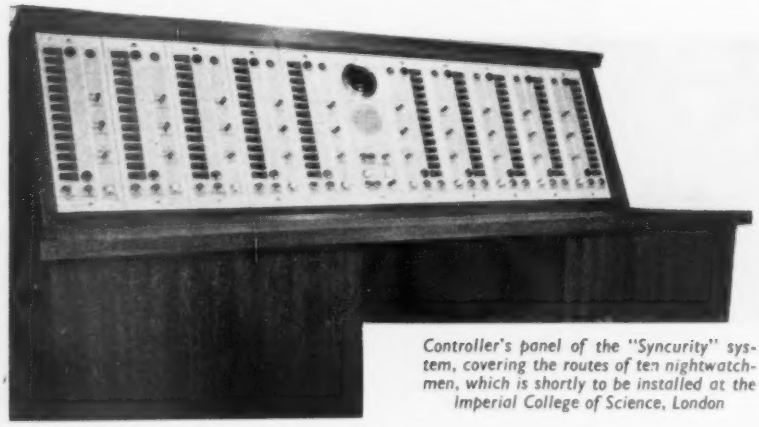
THE news story of the "slugged nightwatchman" is, unfortunately, becoming a little too frequent for comfort these days and what was once regarded as a nice easy job for the retired, elderly man is rapidly coming under the classification of "hazardous occupations." Burglar and fire alarms in themselves are all very well, but they have strict limitations. They cannot, for example, cover such tasks as checking for the window left open inadvertently or the motor left running, tasks which are carried out with almost monotonous regularity somewhere in industry each day. The nightwatchman or, as he is more usually called these days, "security patrol" remains the best insurance against all of the possible disasters which may occur in offices or factories when the staff are absent. In the circumstances, it is reasonable to suggest that he, also, deserves a degree of protection. This aspect of security has been uppermost in the minds of the Synchronome Co., makers of the world famous "Synchronome" master and slave clock systems and time recorders, and, some months ago, they teamed up with Sound Diffusion (Auto-thermatic) Ltd., of Portslade, to see to what extent the double duty of protecting both property and the watchman could be ensured by an electric system. "Syncurity" has been the result.

Patrol Monitor

The basic principle of the system is the monitoring of the route of a watchman through factory or office premises by a controller sitting at a central desk supplemented by a recording system which ensures that no collusion between the controller or nightwatchman in the avoidance of the preset patrol duties shall go unnoticed. The patrol points are all key operated and include a two-way telephone system. Each point is also indicated by a series of light signals on the controller's panel. The set period between the visits to each point and the sequence of points visited are all fixed by a plugged-in unit on the control panel and cannot be altered by the controller, but only by a senior official. Once the patrol commences, with, the insertion of the watchman's key in the lock at the top of his route channel on the board, he is timed from point to point automatically by lights appearing as he inserts the key at the check points.

The controller can communicate with the patrol by depressing a key which has the effect of inducing a high pitched note in the receiver at the next point of call as soon as the key is inserted. Conversely, by leaving his key turned in the lock at the patrol point for more than 5 sec, the same note is induced in the controller's receiver. This enables the latter to halt the timing sequence, if necessary, to allow the patrolman to break the route for the purpose of making some local adjustment found necessary such as closing a window. Should anything prevent the patrolman from reporting on time, or should he be too early or out of sequence at a point, an alarm sounds on the controller's board. If this is not promptly attended to, the equipment automatically calls the police by a recorded message transmitted over the 999 system.

The supervision of the controller can be extended to cover a number of watchmen and the ten-patrol installation shown is shortly to be installed in the Imperial College of Science. On larger installations two or more controllers can be further supervised by a master controller The system can also economically be applied to small factory groups which otherwise could not afford to employ watchmen separately: "Syncurity" will be demonstrated at the Electrical Engineers' Exhibition in April.



Controller's panel of the "Syncurity" system, covering the routes of ten nightwatchmen, which is shortly to be installed at the Imperial College of Science, London

News of the Week

ALL-ELECTRIC HOUSES ROCKET DEMAND PLANNING LEVEL

15 kW per consumer now suggested

CONCERN that the currently accepted planning figure of 3 kW for the after-diversity maximum demand to be assumed per house in new estates is drastically below the realistic level was expressed by speakers in an IEE discussion last week (see p. 245). Engineers from more than one area board, including Mr G. S. Buckingham, chief engineer, Midlands EB, suggested that 15 kW was a more realistic figure for housing estates comprising better class property incorporating electric off-peak floor-warming.

The increase appears to be related not only to the increase in the installed load now associated with all-electric houses, but also to the virtual absence of diversity in the early evening, after the floor-warming installation has been switched in by the time switch.

Figures as high as 15 kW at present apply only to small estates, but they are likely to become more common in the future, and to require careful reconsideration of accepted levels of transformer and mains provision. The magnitude of the jump that has occurred is underlined if a passage from an IEE address by Mr D. P. Sayers (chief commercial officer, CEGB), delivered only 14 months ago, is considered.

He then said that domestic consumers were responsible for an average demand on the national peak of about ¾ kW per consumer, but that in planning new distribution networks "it is necessary to allow for an after-diversity maximum demand of from 1½ to 3 kW, according to the class of property." It is, of course, the time shift from the peak experienced by distribution systems in residential areas to that on the national generation and transmission system that makes domestic electrification attractive, even though it may introduce local difficulties.

42-hr. week in Engineering

THE 42-hr week—a reduction of two hours—is to be introduced in the engineering industry from 28 March. The executive representatives of the 40 unions affiliated to the Confederation of Shipbuilding and Engineering Unions last week decided to accept the offer of the Engineering and Allied Employers' Federation. At that meeting the claim for a pay increase also was abandoned, despite efforts of the ETU president.

Home Heating Exhibition

THE first national "Home Heating and Winter Comfort Exhibition" will be held at the Royal Horticultural Society's New Hall, London, from 19 to 25 August. Some 60 manufacturers will display products designed for domestic heating and comfort, among which electrical appliances will be prominent, including fires and convectors, immersion heaters, underarpet heaters and electric blankets.

The exhibition is for both trade and public, and traders will be asked to distribute invitation tickets among their customers.

RECORD 'FRIDGE YEAR

SALES of domestic refrigerators run by electricity, gas and paraffin reached a record home and export total of 945,360 during last year, the Domestic Refrigeration Development Committee reports.

Sales on the home market, at 849,362, were almost 100% up on 1958 and more than 160% higher than in 1957. The year started well with January refrigerator sales 250% up on the year before.

Appliance Sales level off

A FURTHER levelling off in sales of major domestic appliances is evident in the figures for December for the Electricity Boards in England and Wales. Only refrigerator sales were up on the November figures, but the other items listed showed a small decline. Nevertheless, sales of electric cookers, at 30,236, were only beaten last year in October and November.

Domestic Appliances	Sales in month ended 31 Dec., 1959		Sales in 12 months ended 31 Dec., 1959	
	Total	% change over corresponding period of previous year	Total	% change over previous 12 months
Cookers ...	30,236	+ 1·4	336,951	+ 28·1
Water Heaters:				
Immersion	6,268	− 15·4	189,739	+ 15·7
Storage ...	5,086	+ 14·5	60,549	+ 22·9
Washboilers	4,585	− 20·1	67,112	− 16·9
Washing machines ...	12,352	− 26·0	164,037	+ 58·2
Refrigerators	6,063	− 15·4	165,431	+ 120·2

But the increased sales for the year, compared with 1958, are noteworthy. The board's sales of cookers, for instance, at 336,951, compared with 263,033 in the previous year, and corresponding figures for washing machines were 164,037 and 103,788, respectively.

It must be remembered that these statistics relate only to area electricity boards in England and Wales, whose sales represent only a part of the total for the country.

E.D.A. Publicity Plans for 1960

"GET up to date—go electric" is to be again the 1960 advertising theme of the Electrical Development Association. EDA's "Little Boy," who is rapidly becoming recognised as the national symbol of electricity, will dominate the publicity campaign. Now bigger and livelier, with more personality, the Little Boy will be seen "in action" as he promotes the advantages of electricity in the home.

Plans include illustrated Press advertising in conjunction with the Electricity Boards, supported by display posters and window bills for service centres, and leaflets and price tickets for the point of sale.

A new series of EDA industrial advertisements, following the same successful "data sheet" pattern as before, will appear in a wide range of management and technical publications. Reprints will be available to electricity boards for distribution to their customers.

EDA also plan to participate in a full programme of 19 exhibitions throughout the country during the year.

R.T.P., Monopolies and Take-overs for study

ANSWERING a question in the House of Commons last week, suggesting that the provisions of the Restrictive Trade Practices Act, 1959, tended to encourage rather than diminish monopolies, the President of the Board of Trade said that opinions differed on this topic. He assured the House that the effect of resale price maintenance and the structure of industry and trade would not be neglected in any studies that are made. The various combinations being formed in industry, including take-over bids, would be looked into.

Report on Ocker Hill Boiler Failure

EXTERNAL corrosion of a blow-down pipe caused an accident at Ocker Hill power station, Tipton, Staffs in March, 1958. This is the conclusion stated in a report dated January, 1959, newly published by HMSO. The boiler concerned was designed for 650 lb/sq in. working pressure and, at a time of high water level, the 1¼ in. bore 7/32 in. thick solid-drawn mild-steel pipe burst, inflicting scalding and abrasion injuries to a stoker.

The report suggests that partial failure of a joint had permitted leakage of water to reach a bolt hole and from there the upper face of a flange. The corrosion was caused by water leaking from the joint and then being retained by the lagging, and subjected to temperature changes whenever a blow down or feed water sampling valves were operated.

In his comments on the report, the Engineer Surveyor in Chief to the Ministry of Transport remarks that the accident shows that reliance cannot be placed on leakage being detected by consequent damage to the thermal insulation. Lagging can hide failure even when hydraulic tests are applied. He suggests that some drainage device which would also indicate leakage might with advantage be fitted in connection with flange couplings.

Tyne line objections

PROPOSALS for a 275 kV line from Blyth to Middlesbrough have brought arguments from various local authorities These mainly centre round the route of the line after it crosses the Tyne at Jarrow. The latter Council want the line to go via the railway and through part of South Shields, but the latter Corporation are objecting to such routeing. Several organisations have made objections to the routes proposed and it is likely that a public inquiry will be held.

Increased Borrowing Powers for Gas

A NEW limit of £500 million is proposed to the borrowing powers of the Gas Council and the area gas boards by the Gas Bill now before the House of Commons. The new limit will be £50 million above the existing figure, and will apply up to 31 March, 1966. There is a further provision that the limit may be raised to £525 million if the Minister of Power makes an appropriate order which would require approval by the House of Commons.

In answer to a question the Minister stated that the Gas Council is examining a project to establish a high pressure gas grid system across the Midlands and to London. When it was suggested that the scheme could be put into operation in three years' time with a 25% reduction in the cost of producing gas, Mr Wood said there were a number of factors to be considered, including the question of underground storage, but he would ask the Gas Council if progress could be made fairly quickly.

£650 Damages for C.E.G.B.

DAMAGES amounting to £325 were awarded to the CEGB in the Lancaster County Court recently, against each of two landowners, Mr G. Sagar and Mr J. G. Thompson. The latter had obstructed the erection of the Harker-Penwortham 275 kV line across their land at Caton and Halton. The board were also granted an injunction restraining the two landowners from further interference in the erection of the line, and awarded costs.

Appearing for the CEGB, Mr J. T. Hesketh explained that the Minister of Power, after hearing the objections of each of the landowners, had given his consent permitting erection of the line.

Confidence in Plating

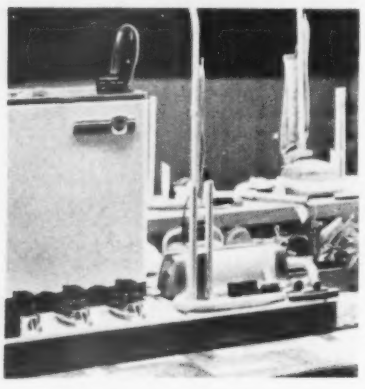
A CONFIDENCE in Plating Conference and Exhibition, organised by the Mond Nickel Co. Ltd., is to be held in Birmingham's Engineering Centre, Stephenson Pl. from 23 to 25 Feb., 10 a.m. to 6 p.m. daily. The exhibition, which features various aspects of nickel and chromium plating, will supplement a series of discussion meetings which have been arranged on 23 Feb. at the Engineering Centre and on 24 Feb., at the Queen's Hotel. A full programme is available from the company at Thames Hse, Millbank, S.W.1.

School's Pylon Battle continues

THE action of the North of Scotland Hydro-Electric Board in placing an electric pylon in, and a high voltage line across, the grounds of the Campbell Rudolf Steiner School for children needing special care, near Aberdeen, was the subject of a question in the House of Commons last week.

Mr Hector Hughes asked the Secretary of State for Scotland how many protests he had received, and what action he had taken to protect the children and the school from the danger to which they were exposed.

Mr Maclay stated that letters had been received from 39 MP's and other sources. The board had taken further measures to supplement the normal safety devices, and these should remove any reasonable anxiety for the safety of the children. No further comment was possible as Court action was pending.



Picture shows part of the Hoover "Our Man in Havana" window display at Selfridges. Similar displays were installed in most other London department stores

HOOVER "HAVANA" PROMOTION

HOOVER have mounted a special exhibition at their showrooms in Regent St, London, to illustrate the co-operation between themselves and Columbia Pictures in the making of the film "Our Man in Havana" and in subsequent joint sales promotion plans.

The exhibition has a Havana theme running throughout. Palms provide a tropical atmosphere which is heightened by Latin-American background music. A trailer of the film is shown. Featured are the range of Hoover products offered as prizes in the £5,000 contest which the company are running in connection with the film.

Later the exhibition will tour Hoover factories and will go to leading stores throughout the country. Meanwhile, promotional plans include special dealer publicity tie-ups and window displays which the company are providing.

OFFICIAL PUBLICATIONS

Fuel Research, 1958, HMSO. 2s 6d. (See page 238.)

BS 3192. Safety requirements for Radio (including Television) Transmitting Apparatus. 6s.

BS G100. General Requirements for Aircraft Electrical Equipment. Draft revision. Part 1. 3s 6d. Part 2. 5s.

Boiler Explosion Acts. Report on explosion from water tube boiler at Ocker Hill power station. HMSO. 1s. (See this page.)

Gas Bill. HMSO. 4d. (See this page.)

Street Lighting and Colour

PROVIDED street lighting is in accordance with the British Standard Codes of Practice, which do not specify colour or type of lamp, there is no evidence to show that confusion is caused by differences in colour or design.

This was stated by the Minister of Transport in the House of Commons last week in a written answer to a question as to whether different kinds and colours of street lights were not confusing to motorists, and whether a uniform pattern and colour of lighting ought not to be introduced.

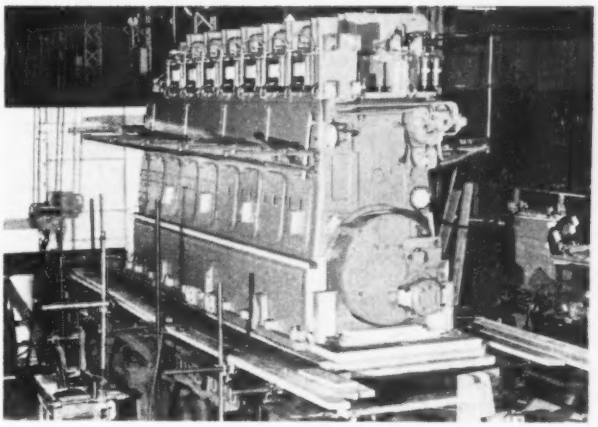
Local authorities installing new lighting usually followed the Codes of Practice, Mr Marples said, and there would seem to be no need for legislation imposing uniformity.

Electrolux 65 Publicity

AN intensive Press and television advertising campaign to introduce the new Electrolux 65 suction cleaner to the public began on Tuesday. Embracing national and provincial newspapers and magazines, and the commercial television network, the campaign will feature the theme: "All your everyday cleaning with only two tools!"

Dealer tie-ups are being arranged, and Electrolux are supplying an attractive demonstration and display stand for Model 65, plus window posters and pelmets.

PAKISTAN BOUND



The first of 11 diesel-generating sets, part of a £500,000 contract, awaiting export to Karachi at the Rugby works of English Electric. The sets will run on natural gas from the Sui gas field in West Pakistan. The station will deliver a full power of 15,000 kW by the end of this year

Problems of Standardisation

A PLEA for a more systematic approach to voltage standardisation by the LEB was put forward by members at last week's meeting of the London Electricity Consultative Council, under the chairmanship of Sir Isaac Hayward. The board's policy of "hopping about" from one area to another, thus leaving pockets of non-standard supply, caused considerable inconvenience to consumers in these low-voltage areas, it was suggested.

As standardisation spread, traders in the area generally ceased to stock and supply non-standard lamps, fittings and appliances, and the problem was aggravated by the fact that many manufacturers were no longer making such appliances as the market for them was decreasing. As a result, a considerable number of consumers were already experiencing difficulty in obtaining lamps and appliances suitable for 200-220 V, and it was felt that the position would worsen during the next few years.

It was recommended that service centres should carry stocks of non-standard products and circularise their consumers that where suitable appliances and lamps are not available from local traders, they may be obtained at the nearest service centre.

While it was appreciated that voltage standardisation was being carried out in the most economical way, at the same time, the convenience of the consumer should be studied.

The practice of the board in changing over in 10 V steps, from 220 to 230 V, and then from 230 to 240 V, was also questioned. The secretary of the Council, Mr E. G. Rawkins, explained that this was not a device to enable the board to evade change-over costs for apparatus and appliances.

The first 10 V uprating from 220 to 230 V enabled consumers to buy standard equipment and also to continue to use 220 V appliances, which were generally tapped for +10 V. On further change-over to 240 V, the board would meet costs involved in the usual way. The intervening 230 V supply gave consumer utility during the change-over period, and minimised inconvenience.

It was agreed that the board should be informed of the various points raised by members regarding standardisation problems.

Tasmanian prospects for U.K. industry

A FOUR-MAN industrial mission with a particular interest in the electrical industry will come to Britain from Tasmania on 6 April, to seek investments in Tasmanian industrial development.

Tasmania, a little over half the size of England, lies south east of the Australian mainland. Natural resources include the cheapest hydro-electric power in the Southern Hemisphere, with an output of 2,143 million kW in 1957, increasing to 2,680 million this year.

Leader of the mission is the Hon R. F. Fagan, Deputy Premier, Attorney-General and Minister for Industrial Development. Other members are Mr A. W. Knight, Commissioner of the Hydro-Electric Commission of Tasmania; Mr K. J. Binns, Under-Treasurer and Commissioner of State Taxation; and Mr H. B. Somerset, a prominent businessman.

The mission would be interested to hear from any British firm wanting information on Tasmania or prepared to offer facilities for the mission to see their factories, via the Agent-General for Tasmania, 457 Strand, W.C.2.

SALES UP IN 1959

SALES of electrical and radio goods by independent retailers were 5% up in 1959 on the year before, although in the months of November and December there was a drop of 10% and 2%, respectively. Department stores sold 12% more electrical, radio and hardware goods during the year, with a gain of 8% in December.

One of the cartoons from a brightly illustrated and most readable booklet entitled "Better Electric Living" published by MK Electric Ltd., and advertised to the general public in various consumer magazines. With the aid of two-colour diagrams, the booklet gives practical advice on planning electrical installations in the home to make the best use of the various appliances, lighting fittings, etc., likely to be needed in living rooms, kitchens, bedrooms, halls and landings, bathrooms, garages, etc. Public demand for the booklet in response to the advertisements has been considerable KM say

£90,000 for machinery

MORE than £90,000 is to be spent by Philips Electrical Ltd. on new machinery for their lighting factory at Hamilton, near Glasgow. The additional equipment will give an estimated 10% increase in production, and will enable the complete operation of lamp manufacture, including the final wrapping, to be carried out in one continuous operation. The installation will be completed towards the end of the year.

Outlook Bright, says F.B.I.

CONTINUED expansion and sustained optimism for the future is the present trend in industry, according to the latest survey by the Federation of British Industries, based on a poll of 724 executives representing British industrial firms. Main feature of the survey is the upward trend in anticipated capital investment this year, 48% of the firms concerned recording an increase in orders for capital equipment, and only 11% a decrease.

The previous inquiry was made in October, 1959, when, for the first time, increase in future investment in plant and machinery outweighed decreases.

The rate of new orders, both home and export, continues to rise, but the trend in export orders still lags behind home trade. Higher output has been achieved both by higher employment and more overtime.

Since the earlier survey last October, more firms report that they are working to capacity, but labour recruitment is becoming a little more difficult. Stocks of raw materials have continued to rise. Despite a hardening of unit costs, 70% of the firms surveyed report no change in the general level of their selling prices.

There is little sign that inflationary pressures have yet begun to operate, the FBI adds, though the hardening labour position may be regarded as a warning for the future.

I.E.S. Summer Meeting

THE biennial summer meeting of the Illuminating Engineering Society is to be held at Harrogate from 15 to 18 May. This time, the number of formal papers is reduced to three, with one day devoted to technical subjects. The three papers are "Research in the field of electric lamps," by H. G. Jenkins (GEC); "Rationally recommended illumination levels," by H. C. Weston; and "Plastics" by C. L. Child (ICI).

Electrical Housecraft Advisers' Conference

SOME 300 electrical housecraft advisers and senior demonstrators are to attend the annual conference organised by EDA and EAW in the Royal Commonwealth Society's Hall, Craven St, W.C.2, from 22 to 25 March. The programme includes talks on domestic appliances, electric cooking, water heating and floor warming, and a number of EDA films will be screened. During the conference delegates will see the many appliances on view at the Ideal Home Exhibition.

£2½ million Order for Steel Plant

ELECTRICAL drive equipment worth nearly £2¼ million is to be supplied by GEC to Richard Thomas and Baldwins for their new steel rolling mill at Llanwern near Newport. The order includes d.c. motors of 7,000 and 8,000 h.p. rating, mercury arc rectifiers, and ancillary equipment for the hot strip and cold rolling mills.

For the same steel plant Wharton Crane and Hoist Co. have received a £300,000 order for overhead travelling electric cranes of various types, with capacities from 10 to 75 tons.

I.E.E. invites papers on non-destructive testing

PAPERS on non-destructive testing in electrical engineering for presentation at a conference on Non-Destructive Testing in Electrical Engineering are invited by the IEE. The conference is being organised by the Measurement and Control Section of the Institution in association with the British National Committee on Non-Destructive Testing, and it will be held at IEE headquarters from 8-10 Nov., 1961.

Anyone wishing to submit a paper for consideration by the organising committee of the Conference, should communicate with the secretary of the IEE, from whom full details regarding the scope of the Conference can be obtained.

Napier to make "Sierracote"

EXCLUSIVE rights to manufacture, use and sell the "Sierracote" and "Sierraglo" in the UK and Europe have been granted to Napier, a member of the English Electric group, by the Sierracin Corporation, USA.

Sierracote is a transparent conductive coating which can be produced with a surface resistance of between 6 and 90 ohms/sq in. It is used for electrically heating aircraft windscreens and cockpit canopies when de-icing or de-misting is required, and complements the Napier "Spraymat" de-icing system.

Lighting literature wins award

A CERTIFICATE of exceptional merit was awarded to Troughton and Young (Lighting) Ltd. for their entry in the Manufacturers' Trade and Technical Literature Competition, 1959, organised by the Royal Institute of British Architects. The competition sets out to improve the standard of typography and presentation of information in trade and technical information. The entries are being exhibited at the Building Centre, London, until 5 March.

Automatic Welding for Car Body Assembly

MULTIPLE electric welding is a feature of the new Pressed Steel Co. works at Swindon which were visited by HRH the Duke of Edinburgh last week. One of the shops is provided with welding electrodes grouped in banks to make as many as 90 welds at one operation. Four of the 11 kV/400 volt substations which supply the factory are concerned with the multiple welding installation alone. The works takes its supply at 33 kV which is transformed to 11 kV for primary distribution. For safety reasons, the many portable hand tools used in the works are operated at 200 c/s, 125 V. For this purpose, two frequency changing sets are provided for each of the buildings making up the factory.

Big Rectifier Orders for Steel Works

RECTIFIER contracts for high-speed tinning lines requiring a total of 430,000 A of direct current have been secured by Westinghouse Brake and Signal Co. The first line is for Richard Thomas and Baldwins Ltd., Ebbw Vale, where the electrical equipment includes 220,000 A of water-cooled germanium rectifiers, transformer, transductors to control plating current, and various automatic controls to govern the thickness of the tinplate. The second line is for Australian Iron and Steel Ltd., at their Port Kembla works, who will require 330,000 A. For this installation air-cooled rectifiers will be used in a recirculating system where the heat is absorbed by sea water and heat exchangers.

At the annual dinner of the Ipswich and District Electrical Association, held recently at Ipswich and attended by 206 members and guests: (left to right) Mr T. R. Scott (managing director, Standard Telecommunications Research Laboratories); Councillor J. R. Lewis (Mayor of Ipswich); J. A. Robertson (chairman of the Association); Dr H. Baines (ex-vice-president of the Royal Institute of Chemistry); Mr E. G. Couzens (technical director, Bexford Ltd.)

Progress in Rural Supply

IN our report on the Eastern Board chairman's lecture last week it has been suggested that the figures relating to farms and other rural premises mentioned in the second paragraph might be taken as referring to the EEB area alone. The figures, of course, relate to the country as a whole and indicate the degree of effort which has been put into rural development by all of the boards collectively.

In the EEB area, the increase in farms with electricity rose from 10,000 in 1948 to 25,000 in 1959, the number of new connections in the year ending 31 March, 1959, being 1,351 farms and 5,110 other rural premises.

UNFAIR TO KNEES?

DESCRIBING his experience when he tried to clean his wife's gas cooker after eating his Christmas dinner, Mr R. Bradbury, chairman of the North West Gas Consultative Council, told members at a meeting last week that he was "appalled" to find that women were expected to get down on their knees to clean cookers. The council decided to urge, through the area board, that manufacturers should produce cookers with removable linings to make cleaning easier.

Orders for Instruments

SIGNAL generators worth £18,000 are to be supplied by Avo Ltd., a company in the Metal Industries group, to the Ministry of Aviation. Another MI company, Taylor Electrical Instruments, has received an order from the GPO for 500 multi-range meters valued at £5,000.

Sayings OF THE WEEK

"I believe that the wholesalers must accept a large amount of responsibility for the breakdown of the trading structure of the industry." . . . MR V. J. STOCK, president, at the ECA annual dinner.

"In recent months I have observed a large influx of new firms into this [appliance] *field, and I have no doubt they will give existing producers a lot of headaches. The economist and the civil servant call such developments 'a diversification of industry,' but I am tempted to call it just 'poaching'."* . . . SIR LESLIE GAMAGE, at the BEAMA Domestic Appliances Export Sales Conference.

"It is most regrettable that our trolley buses should be disappearing from the streets of this country." . . . LORD MERRIVALE in the House of Lords last Thursday.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, February 16

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	267	−10
,, (3 months)	247½	−2
LEAD, refined pig, 99·97% purity (cash)	73½	+1½
,, (3 months)	73½	+1½
TIN, refined, min. 99·75% purity (settlement)	794	+1
(3 months)	792	+3½
ALUMINIUM, ingots 99·99·5%	186	—
,, wire bars 99% purity	209	—
BRASS Strip 63/37	228½	−4½
SILVER (Troy oz)	79½d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	89	−½
,, (3 months)	89½	−¼
RUBBER, per lb.		
No. 1, R.S.S. spot	34½d	+½d
c.i.f. basis, ports, April	33½d	+½d
ARMOURING:		
Galv. Steel Wire (0·104 in.)	66½	—
Mild Steel Tape (0·04 × 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	71½	−½
AMERICAN PRICES:		
Copper, electrolytic (per lb)	35c	—
Lead (New York)	12c	—

* *Tape Price, now an average, includes varnishing*

Looking into Machine Tools

AMONG the members of the sub-committee set up to consider the report by Prof Melman on the European machine tool industry are Mr R. C. Giggins from GEC; Mr J. G. Lloyd from Vickers Armstrong (Engineers) Ltd.; and Mr A. Siddal from Joseph Lucas Ltd., all representing machine tool users.

Other members include Mr R. W. Asquith; Col C. W. Clark; and Mr R. D. G. Ryder, representing machine tool makers. Also, Mr W. J. Carron, president AEU and chairman of the British Productivity Council, representing trade unions; Mr E. T. Grainger, head of the Technical Section of the Engineering Industries Division of the Board of Trade.

The chairman is Sir Steuart Mitchell, who spent five years as chief engineer of the Armament Design Dept., three years as controller of Royal Ordnance Factories, and five years as controller of Guided Weapons and Electronics.

This information was given by the President of the Board of Trade in answer to a question in the House of Commons last week. On the following day, the Minister of Education confirmed that the findings of the Department of Scientific and Industrial Research report on the machine tool industry were being discussed between the DSIR, the Machine Tool Trades' Association, the Board of Trade and the Ministry of Education, with a view to co-ordinating action within the industry.

News in Brief

AEI Heavy Plant Division have received a £200,000 order for germanium rectifiers to be installed at the Steel Co. of Wales' Trostre Works.

Membership of Nalgo rose by 4·4% to over 263,000 last year.

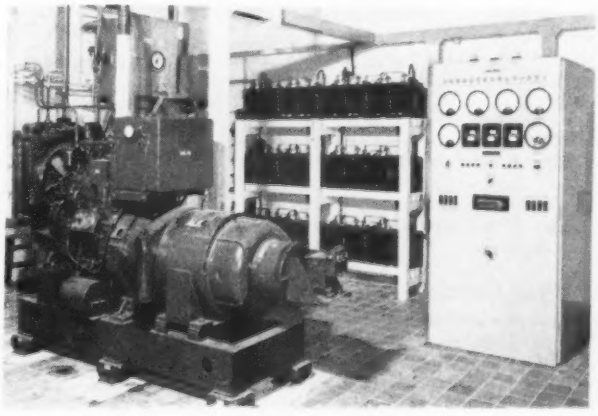
English Electric Co. have made a one-minute colour-sound advertising film on their Liberator automatic washing machine.

Formed 14 months ago, the Gloucestershire Electric Club recently held its annual dinner.

The ex-Johnson and Phillips Association are holding their annual reunion dinner on 5 March, at Grosvenor Hse, Park La, W.1.

The Telecommunications Technicians' Association has been formed by breakaway ETU members.

Weston-super-Mare's new £150,000 street lighting modernisation scheme, now half completed was officially switched on by Ald H. Dodgson, Chairman, Works Committee, on Monday.



Part of the automatic diesel alternator standby power supply plant now in service on the recently completed Independent Television link to East Anglia. This and three similar plants were supplied and installed for the GPO by Troughton and Young Ltd., and further contracts call for three more plants of the same type for Devon and Cornwall ITV link

Company Activities

LAST week's prospect of no trains brought out the old market see-saw. It was definitely a time for the non-professional to "keep-off," although even so the long-term investor would always retrieve what he might have lost on the short-term swings and roundabouts. Generally, electrical shares were subdued, with the one outstanding exception of Crabtree Electrical Industries, whose 10s Ordinary shares in two days gathered 3s 6d on the chairman's interim report. It was not the maintained interim dividend of 7½% that put them up to 56s 6d, but the fact that the proposed one-for-one free scrip issue will attract a final dividend expected to be not less than 7½%. In other words, the total dividend is being raised from 20% to the equivalent of at least 22½% on the present capital. Provision for the new scrip issue is made by the revaluation of fixed assets, which have more than doubled their book value. Group fixed assets are now shown as £1·2 million compared with the balance assumed from the board's dividend expectation, coupled with the bouyant trading conditions reported by the chairman, Mr J. A. Crabtree, last November, that the year's net profits after tax will exceed by a comfortable margin the 1958/59 level of £222,700. Putting the shares on a 22½% dividend basis they now yield a not unattractive 4%.

First of the electrical "giants" to report was the English Electric Co. The final dividend of 7%, making 10% for the year, represents an increase of ½% on the directors' 1959 forecast after taking the intervening one-for-two free scrip issue into account. Group profit fell from £7,017,638 to £6,734,725, but this was after a considerably heavier depreciation charge of £3,571,162 (against £3,137,609 previously), and after a lower tax payment, the net balance attributable to the parent company is actually £108,612 up at £3,125,870. Even so, one could have expected a better outcome to the year's trading.

Following the results, the £1 Ordinary shares dropped fractionally on some profit-taking, but second thoughts on the figures brought back a few buyers so that the shares edged 3d higher by the close of the week's business to 4s 3d.

Meanwhile, we have received from the Federation of British Industries the seventh in their survey series on Industrial Trends ranging over 724 industrial concerns. Their mood is one of optimism. Output and orders are rising while estimates of increased spending on buildings and machinery now confirm earlier Board of Trade forecasts of bigger capital spending in 1960. That part of the survey relating to metals, engineering, shipbuilding and electrical indicates that 36% of the firms asked expect to authorise more capital expenditure on buildings in the next 12 months than in the past year, and 47% expect to spend more on plant and machinery. These estimates are above the general industrial averages of 33% and 45%, respectively. In fact, looked at over the entire range of the inquiry, the prospects for the heavier electrical industry remain distinctly bright.—*From our City Correspondent.*

Barbados Electric Supply Corpn. Ltd.

Unit sales in the year to 30 June last increased by 15·4% to 26·8 million, while the number of consumers rose by 18·4% to 16,597. The results for the first six months of the current financial year show that this improvement is continuing, and the profits should be sufficient to meet interest charges on expenditure for new plant being installed. Mr W. A. Brown, the chairman, states. An additional steam unit will be completed in a few weeks' time and an additional diesel set is to be erected and should be in service by June. Negotiations were recently concluded with the Colonial Development Corporation for the advance of a further £400,000 to finance more expansion.

Crabtree Electrical Industries

While maintaining the interim dividend at 7½%, it is proposed to make a one-for-one scrip issue. It is also forecast that a final of not less than 7½% will be paid on the increased capital for the year ending 31 July next. This would be equivalent to 22½% on the present capital, compared with 20% paid for 1958-59. The group's assets have been revalued, and are now listed at over £1,200,000, compared with the balance sheet figure of £571,000. It is proposed to increase the capital to £1,550,000 by the creation of a further 1,200,000 Ordinary 10s shares.

English Electric Co. Ltd.

Final dividend is 7%, making a total of 10% for the year ended 31 Dec. last, on the increased capital, compared with the equivalent of 9½% for the previous period. After charging depreciation at £3,571,162 (*£3,137,609*), the group profit is down slightly to £6,734,725 from the previous year's figure of £7,017,638.

International Combustion (Holdings) Ltd.

Group profit for the year to 30 Sept. last rose slightly to £1,453,659 from the previous year's figure of £1,137,472. Final dividend is 20% making a total of 35% for the period (25%).

Lancashire Dynamo Holdings

After tomorrow, 19 Feb., the opportunity of LD Ordinary shareholders electing to take Metal Industries' alternative "B" offer, of one half of one Ordinary MI share plus 45s cash, will lapse, and Ordinary stock units will, thereafter, be acquired only on the basis of one new MI Ordinary plus 12s cash. The MI directors stated some days ago that acceptances had been received in respect of over 90% of that part of the LD Ordinary stock to which their offer applied.

Marconi International Marine Communication Co.

A final dividend of 6% maintains the total distribution at 10% for 1959. Group profit is £550,142 (*£521,194*) after depreciation at £631,280 (*£619,031*).

Marconi's Wireless Telegraph Co.

For 1959, the group profit amounts to £900,715 (*£1,028,519*) after charging depreciation at £227,047 (*£198,644*). Dividend remains at 10%.

R. B. Pullin and Co. Ltd.

This group now has widely spread interests in the instruments, optical and photographic equipment spheres and the past year's results indicates that all are making steady progress. Indeed, Mr R. B. Pullin, the chairman, considers the prospects good, and believes that the subsidiaries will each contribute towards the success of the group, although he warns that it is becoming increasingly difficult to forecast results. The parent company has made progress in the industrial field, and with an adequate input of Government orders, production throughout the current year should continue at a remunerative level.

Year to 30 Sept.	£ Trading Profit	£ Net Profit	% on Ord. Earned	% on Ord. Paid	Ord. Price High	Ord. Price Low
1955	179,925	63,455	57	20	9/7	6/-
1956	195,420	73,558	67	20	7/9	5/8
1957	288,525	85,903	37	20	8/3	5/1
1958	357,775	128,081	57	20	8/3	5/10
1959	397,879	147,776	40	30	13/10	7/10

Tube Investments Ltd.

It is proposed to raise £21 million by the issue of new Ordinary shares at a price of 25s each, which is far below the present market price of TI Ordinary, 125s 9d. Some 16,828,702 new £1 shares will be allotted on a one-for-one basis. These will not be entitled to the current interim dividend, of 7½%, but they will rank for the final, which is forecast as not less than 8¼% on the larger capital—double the present equity. The new money is to finance a large expansion programme, including substantial additions to tube-making equipment, more plant for the electrical division, and new steel making and finishing capacity.

Intended Dividends

Electrical Components (Holdings). Interim 4% (*6% on smaller capital*).

Permali. Interim 3%.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

18 Feb.—Edinburgh. (2) Renewal of electrical installations at Board of Management for Edinburgh Northern Hospitals offices. Applications to Secretary and Treasurer, Northern General Hospital, Ferry Rd, Edinburgh 5, by above date.

18 Feb.—Fermanagh C.C. Lighting and heating installation in alterations in County Health Committee offices at Castle Barracks, Enniskillen.—See 4 Feb. issue.

19 Feb.—Belfast T.C. Supplies list items 16 to 40. Advertised 28 Jan. issue.

19 Feb.—Bristol T.C. (B) Electrical installation, by contractors on N.I.C.E.I.C. roll, in new Redland Training College, Redland Hill, on fixed-price basis. Applications to City Architect, Council Hse, Bristol, by above date.

19 Feb.—Cardiff T.C. Electrical installation, on fixed-price basis, in stage three at Llandaff Technical College.—See 28 Jan. issue.

19 Feb.—Fylde. Supply of electrical equipment, fittings, etc.—Advertised 4 Feb. issue.

19 Feb.—Withernsea U.D.C. Lighting work in covering in of Sun Lounge. Council Clerk, K. Allen, Municipal Bldgs, 243 Queen St, Withernsea.

20 Feb.—Bacup B.C. (a) Electrical installations in six bungalows being erected at Tunstead Rd estate, Stocksteads. Borough Engineer, Municipal Offices, Bacup. Deposit £2 2s.

20 Feb. — Dagenham B.C. Wiring of additional lighting point on upstairs landing in 230 properties on Frizlands estate.—See 4 Feb. issue.

20 Feb.—Deal B.C. Supply of lamps for year.—See 4 Feb. issue.

20 Feb.—Garforth U.D.C. Supply of lamps (item 1) for year from 1 April, 1960.—See 4 Feb. issue.

20 Feb.—Halesowen B.C. Supply of (item 12) lamps for year to 31 March, 1961.—See 4 Feb. issue.

20 Feb.—Rustington P.C. Maintenance of street lamps for three years from 1 April, 1960.—See 4 Feb. issue.

22 Feb.—Abingdon B.C. Supply of lamps for year.—See 4 Feb. issue.

22 Feb.—Belfast. Electrical installation in Irish Christian Brothers' Voluntary Secondary Intermediate School for Boys at Glen Rd.—See 4 Feb. issue.

22 Feb.—Chesterton R.D.C. Supply and erection of 28 Group "A" sodium lamps on concrete columns at Caxton.—See 11 Feb. issue.

22 Feb.—Lancs C.C. Electrical installations in Farnworth Cherry Tree Primary School and Padgate Teachers' Training College Hostel No. 8. Applications to County Architect, P.O. Box 26, County Hall, Preston, by above date, quoting reference A/G.

22 Feb.—N. Ireland. Supply of blood storage refrigerators. Secretary, N.I. Hospitals Authority, 27 Adelaide St, Belfast.

22 Feb.—Uxbridge B.C. Supply of (item 16) lamps.—See 4 Feb. issue.

22 Feb.—West Fife. Hospital electrical work maintenance contract for year from 1 April, 1960.—See 11 Feb. issue.

23 Feb.—Orpington U.D.C. Erection of Group "B" columns and installation of associated equipment.—See 4 Feb. issue.

23 Feb.—Wigtown C.C. Electrical installation in conversion of Bellevilla Hse, Stranraer, into old people's home. County Architect, 23 Lewis St, Stranraer.

24 Feb.—Durham C.C. (a) Electrical installations in Whickham new Modern School; renewal of electrical installations in Bearpark County School and Birtley Ravensworth Ter County School. Applications to County Architect, South St, Durham, by above date.

24 Feb.—Newbury B.C. Supply and installation of two identical vertical spindle, unchokeable, centrifugal pumps, together capable of dealing with 1,270 g.p.m.—Advertised 28 Jan. issue.

24 Feb.—Tees Valley. Supply of (item 22) lamps for year.—See 11 Feb. issue.

25 Feb.—Larne B.C. (11) Electrical work (repairs and maintenance) for year to 31 March, 1961. Borough Surveyor, Victoria Rd, Larne.

26 Feb.—Crompton U.D.C. Supply of (item 13) lamps for year to 31 March, 1961.—See 11 Feb. issue.

26 Feb.—Peterborough R.D.C. Erection installation of steel columns and electrical equipment for 93 Group "A" sodium lighting units.—Advertised 11 Feb. issue.

26 Feb.—Redcar B.C. Erection of E.L.E.C.O. columns and lanterns in Redcar La. Borough Engineer, Ridley Hse, Coatham Rd, Redcar.

29 Feb.—Wrexham B.C. Supply and installation of internal telephone system (P.A.X.) in new Guildhall. Applications to Town Clerk, P. J. Walters, Guildhall, Wrexham, by above date.—Advertised in this issue.

27 Feb.—Dewsbury T.C. Supply of: Classes "A" and "B" concrete and steel columns; 140 and 45/60 W sodium lanterns; 250 and 400 W m.v. lanterns; lamps; 100/150 W lanterns; swan-neck brackets and spigots; time-switches; cable and control gear.—Advertised 4 Feb. issue.

27 Feb.—Irlam U.D.C. Supply of lamps for year.—See 11 Feb. issue.

27 Feb.—Stanley U.D.C. Supply of electrical materials.—See 11 Feb. issue.

27 Feb.—West Lothian. Repair and maintenance of hospital electrical installations and equipment (including minor extensions) for year.—See 11 Feb. issue.

29 Feb.—Cardiff T.C. Electrical installation in new gymnasium block in Cardiff High School for Boys, Newport Rd. City Surveyor, City Hall, Cardiff. Deposit £2 2s.

29 Feb.—Carlow C.C. Two sets of duplicate sewage pumps.—See 4 Feb. issue.

29 Feb.—Royton U.D.C. Supply of (c) lamps for year.—See 4 Feb. issue.

29 Feb.—Wellington R.D.C. Electrical installations included in improvements to 129 pre-war council houses at Milverton and Wiveliscombe. Engineer and Surveyor, K. V. W. Harding, R.D.C. Offices, Wellesley Pk, Wellington, Som.

29 Feb.—West Hartlepool T.C. (2) Electrical installation in Brierton Hill Secondary School for Girls.—See 11 Feb. issue.

29 Feb.—W. Riding C.C. Installation of fire alarm system at Hostel for the Aged, Hillworth Lodge, Keighley. Divisional Architect, Salisbury Bldgs, Albert St, Harrogate.

1 March—Dartford B.C. Supply and erection of 30 complete 80 W mercury vapour lamps and lanterns on 15 ft tubular steel columns in Oakfield La. Town Clerk, T. Armstrong, Council Offices, Dartford. Deposit £2 2s.

1 March—Dublin T.C. Supply of fluorescent lamps, mercury fluorescent lamps and control gear. Engineering and Town Planning Dept., 28/29 Castle St, Dublin.

1 March—Leckhampton P.C. Supply and installation of 19 140 W sodium discharge lamps on 25 ft columns on A46.—See 11 Feb. issue.

1 March—Newton Abbot R.D.C. Maintenance of wiring, fittings, etc., in council houses to 31 March, 1961. Engineer and Surveyor, Kingsteignton Rd, Newton Abbot.

1 March—Salford T.C. Supply of (1) 15 ft concrete columns; (2) 60 W sodium vapour lanterns with ancillary equipment; (3) 100/150 W Class "B" lanterns; (4) solar dial synchronous time switches.—See 11 Feb. issue.

2 March—Willenhall U.D.C. Rewiring of Town Yard.—Advertised 11 Feb. issue.

4 March—Midlothian C.C. Supply of (item 9) lamps.—See 11 Feb. issue.

4 March—Notts C.C. Supply and erection of columns, lanterns and switchgear on traffic island on A614.—Advertised 21 Jan. issue.

4 March—Westhoughton U.D.C. Supply of lamps for year to 31 March, 1961. Surveyor, Town Hall, Westhoughton, Bolton.

5 March—Airdrie T.C. Supply of (item h) lamps for year.—See 28 Jan. issue.

5 March—Ashford U.D.C. (c) Rewiring of council houses.—See 11 Feb. issue.

7 March—Bishop's Stortford U.D.C. Wiring work in 28 flats and communal block. Surveyor, Council Hse, Causeway, Bishop's Stortford.

7 March—Bristol T.C. Supply of: (a) curved bar sewage screens, raking gear and pumps; (b) penstocks; (c) comminutors; (d) electrically operated 10 ton and hand-operated 5 ton o/h cranes; (e) metering equipment.

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 106 queries answered this week

"Effeelite" lighting fittings—makers of? M.O.H.—Fredk. Thomas and Co. Ltd., 18/26 Everton Bldgs, Stanhope St, N.W.1.

"Duplex" floor polishers—makers of? P.A.—Electrona Electrical Products Ltd., Islington Mill, James St, Salford 6.

"Daleware" holloware—makers of? I.E.—Easipower Ltd., Shipyard Estate, Hythe, Hants.

New Day Electric (Sales) Ltd.—address for? S.W.E.B.—Dursley, Glos.

Isolating shaver sockets for use in bathrooms—makers of? R.H.—Chilton Electric Products Ltd., Hungerford, Berks; Kentish Electrical and Engineering Co., 112 Albany St, N.W.1.

"Pontavi" measuring bridge—agents for? N.E.—Kandem Electrical Ltd., 711 Fulham Rd, S.W.6.

Sunvic Controls Ltd.—address for? I.E.—Crown Hse, Aldwych, W.C.2.

"Bustler" vacuum cleaners—makers of? B.O.D.—Vacuums Ltd., 135 Aldridge Rd, Birmingham 22b.

Varmaster Ltd.—address for? C.A.—167 Victoria St, Liverpool 1.

Applications to City Engineer and Planning Officer, Cabot Hse, Deanery Rd, Bristol 1, by above date.—Advertised in this issue.

7 March—Buckley U.D.C. 7,200 yd of Group "A" lighting: (a) supply, erection and internal wiring of 25 ft concrete columns, 140 W sodium vapour discharge lamps, lanterns and control gear; (b) supply only of 140 W sodium lamps, lanterns, control gear and outreach brackets.—Advertised 11 Feb. issue.

7 March—Cardiff T.C. Electrical installations in various council houses and flats for period ending Dec., 1961. City Surveyor, City Hall, Cardiff. Deposit £2 2s.

7 March—Newcastle under Lyme B.C. Supply and installation of 23 200 W sodium vapour Group "A" units on 30 ft plain tubular steel columns on A52.—Advertised 4 Feb. issue.

7 March—Scunthorpe B.C. Wiring to modern standards in 243 council houses in Crosby area (groups of 22, 29, 30, 73 and 89 houses).—Advertised 11 Feb. issue.

8 March—Basingstoke B.C. Supply and erection of three pumps with capacity of 2,540 g.p.m. against a 100 ft head of unscreened crude sewage, pumps should be complete with motors, starters, actuating mechanism and ancillary equipment.—See 28 Jan. issue.

8 March—Hastings T.C. Electrical installations in 162 four-storey flats and maisonnettes at Halton redevelopment area.—Advertised 4 Feb. issue.

8 March—Tyne. Supply and erection of three six-ton portal cargo cranes at Tyne Improvement Commission Quay, Albert Edward Dock, N. Shields.—See 4 Feb. issue.

9 March—Bournemouth T.C. Supply of float-operated and electro-magnetic sewage flow recorders.—See 11 Feb. issue.

9 March—Bridge-Blean R.D.C. Completion of electrical installations in 27 houses at Blean. Engineer and Surveyor, Council Offices, 41 Old Dover Rd, Canterbury.

9 March—Kilmarnock T.C. Supply of (item 1) lamps. Burgh Surveyor's Office, 11 London Rd, Kilmarnock.

11 March—Heston and Isleworth B.C. Supply and erection of 44 Group "A" steel columns with colour corrected mercury lamps, lanterns and control gear with the removal of 35 existing columns along B358 from Bath Rd to Hanworth Rd. Borough Engineer's Dept., 88 Lampton Rd, Hounslow. Deposit £2 2s. Advertised in this issue.

12 March—Cheadle and Gatley U.D.C. Supply of lamps, lanterns, swan-neck brackets, switch boxes and concrete lighting columns. Engineer and Surveyor, D. S. Graham, Town Hall, Abney, Cheadle, Ches.

14 March—Bedworth U.D.C. Contract No. 2(i)(d): street lighting and other ancillary works in Stage 1 Roads and Sewers on Exhall Industrial Estate. Details from consulting engineers, Sir Herbert Humphries and McDonald, 276 Monument Rd, Edgbaston, Birmingham 16. Deposit £10 10s.

14 March—Manchester T.C. Electrical installation in Templemead Home for aged persons at Woodhouse Pk.—See 11 Feb. issue.

No date stated—Hastings B.C. Electrical work in 90 houses at Barley La and All Saints Cres.—See 4 Feb. issue.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

1 March—India. Three 18 MW vertical Francis turbine, alternator exciters, pilot generators, etc.; 3 11/110 kV, 22 MVA transformers; indoor and outdoor switchgear; control cables, power cables and junction boxes. Alternatively two 30 MW generators and two 36 MVA transformers for Sholavar H.E. Project. Chief Engineer, Kerala State Electricity Board, P.B. 65, Trivandrum 1. B.o.T. (ESB/4110/60).*

1 March—Sudan. Cables from 0·0225 sq in. 3-core to 0·75 single-core. Central Electricity and Water Administration, P.O. Box 1380, Khartoum. B.o.T. (ESB/3623/60).*

2 March—Australia. 22 kV pin-type insulators; 66 kV switchgear insulators; 66 kV pin-type insulators. Secretary, State Electricity Commission of Victoria, Melbourne. B.o.T. (ESB/4209/10/11/60).*

2 March—Thailand. 15 kV indoor metal-clad switchgear and two spare 15 kV circuit-breakers for substations at N. Bangkok, Prankanong and Wat Lieb. Commercial Dept., Metropolitan Electricity Authority, Chakraphet Rd, Bangkok. B.o.T. (ESB/3178/60/ICA).*

15 March—India. Portable generating sets, pumping sets and diamond core drills. Documents for tender inquiry S.E.133 from Co-ordination Branch, India Store Dept., Bromyard Ave, W.3. Fee: £1 1s 5d. Viewing reference: S.4052/59/NSC/ENG.2.

16 March—Iran. 4,500 metres, three-core 63 kV low pressure cable. Tehran Electricity Board, Tehran. B.o.T. (ESB/3112/60).*

22 March—India. Two 200 g.p.m. against 200 ft head 7¼ in. borehole pumps. Documents, fee 14s 3d, from Co-ordination Branch, India Store Dept., Bromyard Ave, W.3, reference S.3926/59/N.S.C./ENG.2.

22 March—S. Africa. Circulating water pumps plus ash and dust handling plant for Rooiwai Power Station. Controller of Stores and Buyer, P.O. Box 48, Lorentz St, Pretoria. B.o.T. (ESB/1069/60).*

5 April—Brazil. Packaged power station with three 20 MW turbo-generators, four 90 tons per hour oil fired/convertible to coal boilers, including h.f. telephone equipment for Alegrete in the State of Rio Grande do Sul. Comissao Julgador, 11° Andar do Palacio, Municipal de Porto Alegre. B.o.T. (ESB/991/60).*

5 April—India. One 100/20 ton, 75 ft span o/h travelling crane for Amarkantah Thermal Station. Documents for tender inquiry S.E.143 from Co-ordination Branch, India Store Dept., Bromyard Ave, W.3. Fee: £1 1s 5d, reference: S.3964/59/NSC/ENG.2.

14 June—New Zealand. Three vertical 30 MW, 33,333 kVA 11 kV, 3-ph. generators complete. Secretary, Tenders Committee, New Zealand Electricity Dept., Wellington. B.o.T. (ESB/29798/59).*

Gazette Announcements

COMPANIES ACTS

Ryhope Electrix Ltd. and **R. Bartlett (Electrical) Ltd.** Creditors to send details to liquidator: N. W. Osborne, 1 John St, Bedford Row, W.C.1, by 24 Feb.

A. Lace and Co. (Electrical) Ltd. Mr R. W. Hellyer, Brotherton Chmbrs, Westgate, Leeds 1, appointed liquidator at extraordinary general meeting on 15 Jan., for the purpose of voluntarily winding-up.

Luminaire Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 19 Feb., at 10.15 and 10.45 a.m., respectively.

Grunther Instruments Ltd. Petition for winding-up to be heard before the High Court of Justice, Strand, W.C.2, on 22 Feb. Persons intending to appear to notify Matthew Trackman, Lifton and Cunnington, 1 Dover St, W.1, by 1 p.m., 20 Feb.

BANKRUPTCY ACTS

Voluntary Liquidation

Grafton Heater Co. Ltd., manufacturers of domestic and electrical appliances.

The approximate statement of affairs presented to a recent meeting of creditors showed liabilities of £37,920, of which £23,324 was to trade and expense creditors; while assets were estimated to produce £7,529, after allowing £731 for preferential claims, leaving a deficiency of £30,391.

Trading accounts of the company, registered in 1953, disclosed that to April, 1955, on a turnover of £223,000, there was a net loss of £3,500, but in the following year there was a net profit of £4,500 on a £121,000 turnover; while in the year to April, 1957, on a £73,000 turnover a net loss of £1,700 was incurred. Draft figures for the year to April, 1958, revealed the turnover had further declined to £62,000 with a net loss of £2,900.

Mr R. A. H. Gullett, director, attributed failure to the fall in turnover; loss of a substantial Ministry of Supply contract for irons; and to the fact that paraffin heaters were free of tax.

Mr F. N. Phipps, 329 High Holborn, London W.C.1, was appointed liquidator.

BANKRUPTCY ACTS

Receiving Order

High Court of Justice. K. W. Roberts, dealer in electrical goods, of 1-3 Oglander Rd, S.E.15. Receiving order dated 3 Feb.

First Meeting and Public Examination

Sheffield. R. Lindsay and G. Axom, electrical appliance retailers, trading in partnership as L. and A. Electrical Co. at 331 Beckett Rd, Wheatley, Doncaster, and 585 Anlaby Rd, Hull. First meeting: 2.30 p.m., 19 Feb., at Official Receiver's Office, 55 Queen St, Sheffield 1; and public examination: 2 p.m., 28 April, at County Court Hall, Bank St, Sheffield 1.

CONTRACTS PLACED

C.E.G.B. (E.L. and S.E. Region). 66 kV and auxiliary cables at Fulham Power Station, B.I.C.C., £6,451; 132 kV, 11 kV and auxiliary cables at Sydenham substation, Pirelli General, £17,494; Lighting and Heating at Northfleet West grid substation, G. E. Wallis and Sons, £6,807; 33 kV switchgear and protective equipment at Ruckinge/Dungeness substation, Reyrolle, £13,259; 45 MVA transformers and earthing transformers at West Norwich substation, English Electric, £100,994; 33 kV and auxiliary cables at Sundon substation, Pirelli General, £9,067.

Stockport B.C. Electrical installations at Hollywood Pk Primary School, W. Toovey, £1,851. Recommended.

Swindon B.C. Rewiring and improvements at Westcott secondary and infants' schools, Lee Beesley and Co. Ltd., £2,644.

TRADE NOTES

Beama Contract Price Adjustment Formulae. *For Electrical Machinery and Equipment.* For purposes of calculating variations in (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Feb., 1960, shall be deemed to be 196s; (*b*) "Cost of Material"—the index figure for materials used in the Electrical Machinery Industry at 12 Feb., 1960, is 116·6* (180·9*).

For Turbo-Generating and Allied Plant. For purposes of calculating variations in: (*a*) "Rates of Pay"—the rate of pay for adult male labour at 12 Feb., 1960, shall be deemed to be 196s. (*b*) "Cost of Material"—the index—figures at 12 Feb., 1960, are: Materials used in Mechanical Engineering Industries, 125·9* (189·2*). "Blast Furnaces and Iron and Steel Melting and Rolling (1948 S.I.C. ref. 40/41)" 189. Other Steel Goods, excluding tubes (1958 S.I.C. ref. 311/2, 129·0. The price of brass condenser tubes ½ in. o/d 18 s.w.g. on 12 Feb., 1960, is 4s 3½d per lb. *Provisional figure.

The figures in parentheses shown above relate to the earliest list of wholesale price index numbers in which the year 1949 is taken as the base 100. For the other figures 1954=100.

Licence. Albert Mann Engineering Co. Ltd., Basildon, Essex, have concluded a licensing agreement with Lamer Machine Manfg. Co. Inc. and its subsidiary, Labeck Casting Processes Inc., of New York City.

BUSINESS PROSPECTS

Home

Aberdeen T.C. £1 million technical college in Spring Gdn approved.

Abingdon R.D.C. Community centre included in provisions for £35,000 development at rear of Elms Parade.

Atherstone R.D.C. To undertake £223,238 alterations to council offices.

Barnes B.C. To erect 114 flats at Beverley Brook site. Borough Engineer, Sheen La, S.W.14.

Barrowford U.D.C. Erection of 24 two-storey flats in four blocks. Engineer and Surveyor, Halstead La.

Basingstoke B.C. Recommended to apply for £225,862 loan sanction for new municipal buildings.

Bishop Auckland U.D.C. Erection of a further 115 houses for employees of a local firm being considered.

Cardiff T.C. Erection of grammar school for boys at Fairwater. Architect, 12 Park Pl.

Carlisle T.C. To obtain tenders for another 100 houses on Morton housing estate.

Chesterfield T.C. To erect five blocks of flats on Peveril estate. Borough Surveyor.

Conisbrough U.D.C. Erection of 31 Unity flats at March Gate. Engineer and Surveyor, 5 High St.

Croydon B.C. Recommended to spend £100,000 per annum on modernisation of pre-war dwellings.

Darlington. J. V. Spencer, 171 Albert Rd, Middlesbrough, is architect for factory additions for Tin Boxes Ltd. Cordingley and McIntyre, Owengate, Durham City, are architects for extensions for F. Bookless and Co. Ltd.

Devon C.C. Erection of branch library at Paignton. County Architect, 97 Heavitree Rd, Exeter.

Elstree R.D.C. Propose to erect £236,000 public hall and swimming pool in Elstree Way.

Gateshead. Liner Concrete Machinery Co. Ltd., to extend workshops and offices near Shearlegs Rd. T.C. to erect a municipal health centre at Wrekenton.

Hartlepool B.C. Erection of 36 houses, four maisonnettes and garages in Throston Redevelopment Area. Borough Engineer.

Hastings B.C. Erection of one single-storey block and first three storeys of main block of College of Further Education. Borough Engineer, 37 Wellington Sq.

Huntingdon T.C. To erect 250 houses for first part of L.C.C. overspill housing scheme. Borough Surveyor.

Manchester T.C. Erection of technical high school for girls at Harpurhey. City Architect. P.O. Box 488.

Middlesbrough T.C. Erection of 10 bungalows, 32 flatlets and four houses at Thorntree; 20 houses at Pallister Park and 10 police houses in Easterside. Borough Engineer. Final plans to be prepared for Thorntree Community Centre.

Middlesex C.C. Recommended to approve: £171,773 extension to Roxeth Manor Secondary Schools and erection of £230,175 Broom Rd Secondary School.

Newcastle upon Tyne. L. J. Couves and Partners, Grainger Chmbs, Hood St, Newcastle, have prepared plans for a steel-framed building at Elswick Court to house hairdressing salons, tobacco and confectionery shops, staff rooms, etc. T.C. plan to erect 270 multi-storey flats in three blocks on the Eastfield Ave site.

North Riding C.C. E.C. to erect second instalment of Brotton Modern School (£46,000), Redcar Coatham Modern School (£44,650) and Thornaby Grange Modern School.

Northwich U.D.C. Erection of four houses and 30 bungalows on Malpas Rd estate. Engineer and Surveyor.

Oundle and Thrapston R.D.C. To erect 26 dwellings, garages and children's playground. Surveyor, Oundle, Northants.

Pembroke C.C. Erection of new three-bay fire station in High St, Pembroke Dock. Architect, County Offices, Haverfordwest.

Peterborough. Education Board, improvements to Arthur Mellows Village College, Glinton. Peterborough Joint Education Board Architect, Bridge St.

Port Talbot B.C. Erection of branch library at Morrison Rd, Sandfields, Aberavon. Borough Engineer.

Rutland C.C. To erect £14,000 four additional classrooms at Oakham Primary School.

Salford T.C. To erect 28 maisonnettes in three four-storey blocks at Oaklands Rd. City Engineer and Surveyor's Department.

Saltash B.C. Erection of 20 houses and garages on Grenfell Ave fifth extension housing site. Surveyor, Church Hse.

Sedgefield. Newcastle Hospital Board scheme for extensions to Winterton Hospital is out to tender. Architects: Fennell and Baddiley, Bridge End Chmbs, Chester-le-Street.

Southampton B.C. Erection of three-classroom annexe at Weston Pk Infant's School. Borough Architect.

South Kesteven R.D.C. To erect 32 dwelling houses in 1960.

South Shields T.C. E.C. proposes £950 in estimates for rewiring of infants' department of Stanhope County School.

Sunderland. Newcastle Regional Hospital Board, Benfield Rd, Newcastle, to erect additions to Sunderland Maternity Hospital.

Swinton B.C. Erection of two bungalows with electric floor heating. Borough Engineer.

Taunton R.D.C. Erection of 42 dwellings on six sites. H. S. W. Stone and Partners, 20 The Cres.

Thetford B.C. Erection of 22 dwellings on Magdalen St housing site. Architect, C. L. Lister, Garsett Hse, S.. Andrew's Hall Plain, Norwich.

Thornaby-on-Tees T.C. To invite tenders for a block of flatlets in Lanehouse Rd, and to erect bungalows in the same area.

Thornbury R.D.C. Erection of 36 accommodation units at Upper Bath Rd and Chapel St. Architects: Rainger, Rogers and Smithson, Glenmore Lodge, Wellington Sq, Cheltenham.

Tonbridge R.D.C. Erection of eight blocks of four one-bedroom flats and three pairs of three-bedroom houses on three sites. Council Engineer and Surveyor, 48 Pembury Rd.

Towcester R.D.C. Erection of 20 houses on three sites at Towcester, Connegar Leys, Yardley Gobion and Maidford. Surveyor, 163 Watling St West.

Walsall B.C. Erection of 56, 64 and 54 houses (contracts 1, 2 and 3) on Beechdale estate; 12 houses Woodwards Rd; 42 houses Hildicks Bridge. Engineer and Surveyor.

West Hartlepool T.C. To consider tenders for 30 houses at the rear of Farndale Rd, Seaton Carew.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Acme-Efco Ltd., Sheerwater, Woking, Surrey. Designers, manufacturers and operators of plant, machinery and apparatus for grinding, polishing and finishing metals, etc. Nom. cap.: £20,000. Subs.: N. W. Cooke and Chas. E. May.

Brock (Electrical Installations) Ltd., Piell's Yard, Elliott Rd, Bromley, Kent. Nom. cap.: £1,000. Dirs.: Henry Brock (ch) and Doris M. Brock, 50 Eastry Ave, Hayes, Kent.

H. H. Brown Ltd., 354 Abbeydale Rd, Sheffield 7. Electrical engineers, etc. Nom. cap.: £2,000. Dirs.: Harry H. Brown and Mrs Kate Brown.

J. A. Bunyan Electrical Ltd. Mechanical engineers, etc. Nom. cap.: £100. Dirs.: not named. Subs.: Mrs Ethel M. Patten, and Mrs Beryl J. Burrows.

Electrical Appliances (Moortown) Ltd., 1 Sandhill La, Leeds 17. Nom. cap.: £1,000. Dirs.: Edward L. Etherington, Mrs Joan Winn and James M. Rushton.

Endometrics Ltd. Exploiters and manufacturers of and dealers in electronic instruments, etc. Nom. cap.: £15,000. Dirs.: not named. Subs.: John C. S. Hibbert and John Fenner, 109 Clifton Ct, N.W.8.

F.G. Domestic Enterprises Ltd., 6 Park Grove, Cardiff. Manufacturers of and dealers in artificial lighting apparatus, etc. Nom. cap.: £1,500. Dirs.: Donald G. Fletcher and Selwyn Fletcher.

Galaxy Domestic Appliances Ltd., Post Office, High St, Wickwar, Glos. Manufacturers of and dealers in electrical equipments, etc. Nom. cap.: £500. Dirs.: Kenneth J. Cullis and Gordon E. Egan.

Hansell (Electrical) Ltd., Warley Chmbrs, Warley Rd, Hayes, Middx. Electrical engineers, etc. Nom. cap.: £2,000. Dirs.: Stanley R. Hansell and Mrs Phyllis N. Hansell.

J. A. Keig Ltd., 71 Princes St, Bishop Auckland, Co. Durham. Manufacturers of and dealers in electrical equipment and accessories of all kinds, etc. Nom. cap.: £2,000. Permt. dirs.: James A. Keig and Mrs Margaret E. T. Keig.

J. F. Laight and D. A. Jolley (Coventry) Ltd., 105 Far Gosford St, Coventry. Electrical equipment specialists, etc. Nom. cap.: £500. Permt. dirs.: John F. Laight and Derek A. Jolley.

Lucigem Ltd., 187/9 Commercial Rd, E.1. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £1,000. Dirs.: L. Shocket and Mrs M. Shocket.

Mau-Bit Distributors Ltd., 42a Cheriton High St, Folkestone. To carry on business of manufacturers of and dealers in radio, electrical and mechanical apparatus, etc. Nom. cap.: £100. Dir.: Leslie P. Tibbitts.

Rashleigh Phipps and Co. (Middle East) Ltd. Electrical, mechanical and general engineers, etc. Nom. cap.: £25,000. Dirs.: not named. Subs.: J. M. Beale and J. B. A. Lallis, 18 Austin Friars, E.C.2.

Sahlin Automation Ltd., 31/45 Gresham St, E.C.2. Manufacturers of and dealers in machine tools and automation devices, etc. Nom. cap.: £10,000. Dirs.: Fredk. H. Gardner, Eugene Byrne, Richard T. Sahlin, Harry J. Tiffany and John W. DeLind.

S.C. Electrics Ltd., 333 Broadway, Bexleyheath. Nom. cap.: £2,000. Dirs.: K. E. Beart and S. C. Collyer.

Samos Electrical Ltd., 324 Gray's Inn Rd, W.C.1. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £1,000. Dirs.: Joseph Moss and Sadie Moss.

Jack Sherlow Ltd., 5/6 Abbey Green, Nuneaton, Warwickshire. Vacuum cleaner and washing machine specialist carried on at 5/6 Abbey Green, Nuneaton, as "F. C. Sherlow" by Frederick C. Sherlow. Nom. cap.: £100. Dirs.: Frederick C. Sherlow and Margaret V. Sherlow.

Stevens-Forge Electrical Co. Ltd., Lloyds Bank Chmbrs, Lansdown, Bournemouth. Nom. cap.: £1,000. Dirs.: Kenneth P. Stevens and Derek P. Forge.

Temple Supplies (Dover) Ltd., Ewell Hill, Temple Ewell, nr. Dover, Kent. Manufacturers of and dealers in electrical and electronic apparatus, etc. Nom. cap.: £1,000. Permanent dirs.: Lionel J. W. Robinson and Mrs Edith J. Robinson.

MEETINGS TO NOTE

THURSDAY, 18 FEB.

I.E.E. (Utilisation Section). "Electricity in the Manufacture of Hydrogen Peroxide," B. E. A. Vigers. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S.W. Sub-Centre). "The Provision of Adequate Electrical Installation in Houses." C. C. Hyams. Electric Hall, Torquay. 3 p.m.

I.E.E. (Irish Branch). "Television Systems." H. De Lacy. Physical Laboratory, Trinity College, Dublin. 6 p.m.

S. Wales Institute of Engineers. "Nuclear Energy from Fission and Fusion Reactions." Dr T. E. Allibone. Park Pl, Cardiff. 6 p.m.

Ministry of Works. "Safety in the Building Industry." J. A. Hayward. Hertfordshire College of Building, Hatfield Rd, St. Albans. 7.15 p.m.

Institute of Fuel (N.W. Section). "Problems with the Use of High Sulphur Oil Fuels at Marchwood Power Station and Experience with Chemical Additives." T. J. Wilkinson and D. Clarke. Engineers' Club, Albert Sq, Manchester 2. 7.30 p.m.

Chelmsford Engineering Society. "Design in Engineering Products." L. B. Archer. Social Hall, Hoffmann Mnfg. 7.30 p.m.

Institution of Production Engineers. "Horizontal Boring Machine Development including Electronic Control." C. A. Sparkes. 39 Elmbank Cres, Glasgow C.2.

Society of Instrument Technology (Bristol Section). "Transducers." R. Russ. Bristol University, Department of Physics, Bristol 8. 7.30 p.m.

Society of Instrument Technology (E. Midlands Section). "Instrument Engineering at the National Institute for Medical Research." W. C. Lister. Derby College of Technology, New Bldg, Kedleston Rd, Derby. 7.15 p.m.

Society of Instrument Technology (Tees-side Section). "The Errors of Instruments—their Study and Importance." H. Kenney. Cleveland Scientific and Technical Institutes, Corpn. Rd, Middlesbrough. 7.30 p.m.

FRIDAY, 19 FEB.

I.E.E. (E. Midlands Centre.) Dinner-dance. Victoria Station Hotel, Nottingham. 7.30 p.m.

I.E.E. (N. Staffs Sub-Centre). Annual dinner. Crown Hotel, Stone. 7.30 p.m.

Junior Institution of Engineers. "The Design Features of Large Radio Telescopes." J. Heywood. 14 Rochester Row, S.W.1. 7 p.m.

I.E.E. (Rugby Sub-Centre). Faraday Lecture, Prof G. M. Say. Temple Speech Room. 7.30 p.m.

Institute of Physics (Non-destructive Testing Group). "Electroluminescent Image Intensifiers." Dr P. Schagen. 47 Belgrave Sq, S.W.1. 6 p.m.

MONDAY, 22 FEB.

I.E.E. (Informal Meeting). Discussion: "Are We Making the Best Use of Research Resources?" Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (E. Anglian Sub-Centre). Discussion: "The Provision of Adequate Electrical Installations in Buildings." Technical College, Cambridge. 6.30 p.m.

I.E.E. (N.W. Mersey and N. Wales Centre). "A Frequency-response Method for the Predetermination of Synchronous-Machine Stability." A. S. Aldred and G. Shackshaft. Town Hall, Chester. 6.30 p.m.

I.E.E. (N.E. Centre). "The Characteristics and Protection of Semi-conductor Rectifiers." D. B. Corbyn and N. L. Potter. Neville Hall, Westgate Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (S. Midlands Electronics and Measurement Group). Silicone Transistors—Their Manufacture and Fields of Application." J. T. Kendall. James Watt Memorial Institute, Birmingham. 6 p.m.

I.E.E. (Western Utilisation Group). "The Spark Machining of Hard Metals." G. H. Townend. S. Wales Institute of Engineers, Cardiff. 6 p.m.

Royal Society of Arts. Cantor Lecture. "The Fuel and Power Industries and National Prosperity." Dr A. Parker. John Adam St, W.C.2. 6 p.m.

Engineering Materials and Design Exhibition at Earls Court until 26 Feb.

Institution of Production Engineers (N. Midlands Region). "Railway Modernisation." J. Oakton and W. Marrian. Louis Room, St. James's Restaurant, St. James's St, Derby. 7 p.m.

Institution of Plant Engineers (Birmingham Branch). "Modern Welding Methods." R. T. Andrews. Hotel Leofric, Coventry. 7.30 p.m.

I.E.S. (Birmingham Centre). Annual General Meeting. Regent Hse, St. Phillip's Pl, Colmore Row, Birmingham. 6 p.m.

I.E.S. (Leeds Centre). "The Design and Manufacture of Neon Signs." A. Urquhart. British Lighting Council, 24 Aire St, Leeds 1. 6.15 p.m.

I.E.S. (Leicester Centre). "Practical Aspects of Neon and Other Luminous Signs." T. Coates Demonstration Theatre, E.M.E.B., Charles St, Leicester. 7 p.m.

TUESDAY, 23 FEB.

I.E.E. (Education Discussion Circle). "Courses for Electrical Technicians." Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (N.W. Supply Group). "The Application of Low-Pressure Resins to Some High-Voltage Switchgear Designs." T. R. Manley, K. Rothwell and W. Gray. Engineers' Club, Albert Sq, Manchester. 6.15 p.m.

I.E.E. (S.W. Scotland Sub-Centre). "The Ultra-Sound Image Camera." C. N. Smyth and J. Sayers. Royal College of Science and Technology, Glasgow. 6 p.m.

I.E.E. (N. Ireland Centre). "The Linear Induction Motor." E. R. Laithwaite. David Keir Bldg, Queen's University, Stranmillis Rd, Belfast. 6.30 p.m.

A.S.E.E. (E. Kent Branch). "Nuclear Energy." B. H. Stonehouse. County Hotel, Canterbury. 8 p.m.

Institution of Mechanical Engineers (Lubrication Group). Discussion: "Water Lubrication." 1 Birdcage Walk, S.W.1. 6 p.m.

Institute of Physics. "Magnetic Properties of Alloys." Dr W. M. Lomer. 47 Belgrave Sq, S.W.1. 5.30 p.m.

Society of Instrument Technology. "Back-scatter Method of Wall Thickness Measurement." D. F. White and L. E. Taylor. "Ultrasonic Resonance Method of Wall Thickness Measurement." M. V. James. Manson Hse, 26 Portland Pl, W.1. 7 p.m.

WEDNESDAY, 24 FEB.

I.E.E. (Electronics and Communications Section): "Applications of Microwaves." Professor A. L. Cullen. Savoy Pl, W.C.2. 5.30 p.m.

I.E.E. (S.E. Scotland Centre). "The Ultra-Sound Image Camera. Dr C. N. Smyth. Carlton Hotel, North Bridge, Edinburgh. 7 p.m.

I.E.E. (Rugby Graduate and Student Section). "Some Engineering Aspects of South African Gold Mining." J. C. Cunningham. Rugby College of Technology and Arts. 6.30 p.m.

I.E.E. (Southern Centre). "Development of the Formulae of Electro-magnetism in the M.K.S. System." P. Vigoureux. Central Telephone Exchange, Park Rd, Portsmouth. 6.30 p.m.

Institution of Mechanical Engineers. "Wetness in Steam Cycles." B. Wood. 1 Birdcage Walk, S.W.1. 6 p.m.

British Institution of Radio Engineers (Medical Electronics Group). "The Unification of Electronic Clinical Instruments." Dr F. D. Stott. London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 6.30 p.m.

Institute of Fuel. "Comparison of Different Methods of Fluid-atomising Oil Flames." "The Effect on Flame Emissivity and Radiation of the Addition of Carbon Black to Liquid Fuels. E. H. Hubbard. Institution of Civil Engineers, Gt. George St, S.W.1. 5.30 p.m.

Ministry of Works. "Electric Floor-Warming." F. R. Crook. Gloucester Technical College, Brunswick Rd, Gloucester. 7.30 p.m.

THURSDAY, 25 FEB.

I.E.E. Annual dinner at Grosvenor Hse, Park La, W.1. 7.30 p.m.

I.E.E. (N. Midlands Centre). "Subscriber Trunk Dialling." D. A. Barron. Y.E.B. Offices, Ferensway, Hull. 6.30 p.m.

I.E.E. (Western Utilisation Group). "The Organisation of Industrial Electrical Maintenance." S. R. Phelps. Demonstration Theatre, S.W.E.B., Kingsway, Swansea. 6 p.m.

A.S.E.E. (Brighton Branch). "Stage Lighting in Schools and Small Halls." F. E. Brown. New Imperial Hotel, First Avenue, Hove. 7.30 p.m.

A.S.E.E. (Oxford Branch). "Electric Motor Control Gear." R. F. Mathieson. Reactor School, A.E.R.E., Harwell. 5.45 p.m.

A.S.E.E. (Southampton Branch). "A.C. Motor Control Gear." S. H. Harding. Polygon Hotel, Southampton. 8 p.m.

A.S.E.E. (S. London Branch). "Control Aspects of Nuclear Power Stations." R. D. Trotter. Greyhound Hotel, High St, Croydon. 8 p.m.

Ministry of Works. "Electric Floor-Warming in Practice." R. M. Lang. Cornwall Technical College, Trevenson. 7 p.m.

FRIDAY, 26 FEB.

I.E.E. (London Graduate and Student Section). Conversazione and dance. Friars Hse, Blackfriars Rd, S.E.1. 7 p.m.

I.E.E. (N.E. Graduate and Student Section). "Training in the Electrical Supply Industry." P. A. Balmbra. Grey Hall, King's College, Newcastle. 6.30 p.m.

Institution of Production Engineers (Wales Region). "Some Recent Impressions of the Soviet Union." Dr D. F. Galloway, S. Wales Institute of Engineers, Park Pl, Cardiff. 7 p.m.

MONDAY, 29 FEB.

I.E.E. (N.E. Measurement and Electronics Group). "Radio Aspects of the International Geophysical Year." R. L. Smith-Rose. Rutherford College of Technology, Newcastle. 6.15 p.m.

Royal Society of Arts. Cantor lecture: "The Fuel and Power Industries and National Prosperity." Dr A. Parker. John Adam St, W.C.2. 6 p.m.

Institution of Production Engineers (S.W. Region). "Machine Tool Control." O. S. Puckle. N. Gloucestershire Technical College, The Woodlands, The Park, Cheltenham. 7 p.m.

Institution of Plant Engineers (W. and E. Yorks). "Railway Electrification." W. T. Stephenson. Houldsworth School of Applied Science, Leeds University. 7.30 p.m.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Aquaspin. 793,728. Class 7. Machines for drying clothes. Fisher and Ludlow Ltd., Albion Wks, Kingsbury Rd, Birmingham 24.

Bo-We. B779,958. Class 9. Apparatus, etc. Bohler and Weber, Kommanditgesellschaft, 6 Memminger Strasse, Augsburg, Germany.

Cambion. 791,253. Class 9. Components, etc. Cambridge Thermionic Corpn., 445 Concord Ave, Cambridge, Massachusetts, U.S.A.

Datatrol. 789,655. Class 9. Apparatus for positioning the slides of machine tools. Alfred Herbert Ltd., Canal Rd, Foleshill, Coventry.

Dynistor. 794,600 and **Trinistor.** 794,599. Class 9. Semi-conductor diode and triode switching devices. Westinghouse Electric Corpn., 3 Gateway Centre, Pittsburgh, Pennsylvania, U.S.A.

Luminette. 792,516. Class 9. Magnifying glasses incorporating means of illumination. Combined Optical Industries Ltd., Plasta Rd, Slough, Bucks.

Lyvia. 795,185. Class 11. Christmas tree lighting sets, etc. S. D. Sullam Ltd., 9/11 Tabernacle St, E.C.2.

Mictran. 790,417. Class 9. Transformers and coils. Wireless Telephone Co. Ltd., Hallamgate Wks, Crookes Rd, Sheffield 10.

Orthotone. B790,932. Class 9. Sound recording and reproducing apparatus, etc. Scientific and Technical Developments Ltd., Melbourne Wks, Melbourne Rd, Wallington, Surrey.

Pace in design. B774,603. Class 9. Electronic analogue computing installations, etc. Electronic Associates Inc., Long Branch Ave, Long Branch, Monmouth County, New Jersey, U.S.A.

Pye in design. 792,472. Class 7. Couplings operated by magnetic induction. B789,813. Class 9. Telephone instruments, etc. Pye Ltd., St. Andrew's Rd, Cambridge.

Regmar. 796,673. Class 7. Washing machines, etc. J. and D. Clayton (Hemel) Ltd., 9/13 Bridge St, Hemel Hempstead, Herts.

Solella. 792,831. Class 9. Radio and television apparatus, etc. Radio and Allied Industries Ltd., Langley Pk, Slough, Bucks.

Space. 782,139. Class 9. Computing apparatus. Solartron Electronic Group Ltd., Solartron Wks, Queen's Rd, Thames Ditton.

Starlette. 790,789. Class 11. Refrigerators, etc. Frigeco, 36 Avenue Kleber, Paris, France.

Telomex. 794,383. Class 9. Apparatus, etc. Telomex Ltd., Queen St, Horsham.

Temotrol. 794,741. Class 9. Apparatus, etc. Printers Heaters Ltd., Kingswood Wks, North Orbital Rd, Watford, Herts.

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TRANSFORMER DIVISION — HEATING & WELDING DEPARTMENT

Trafford Park - - - Manchester 17

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We thoroughly—repeat thoroughly—test all our Control Gear before dispatch !

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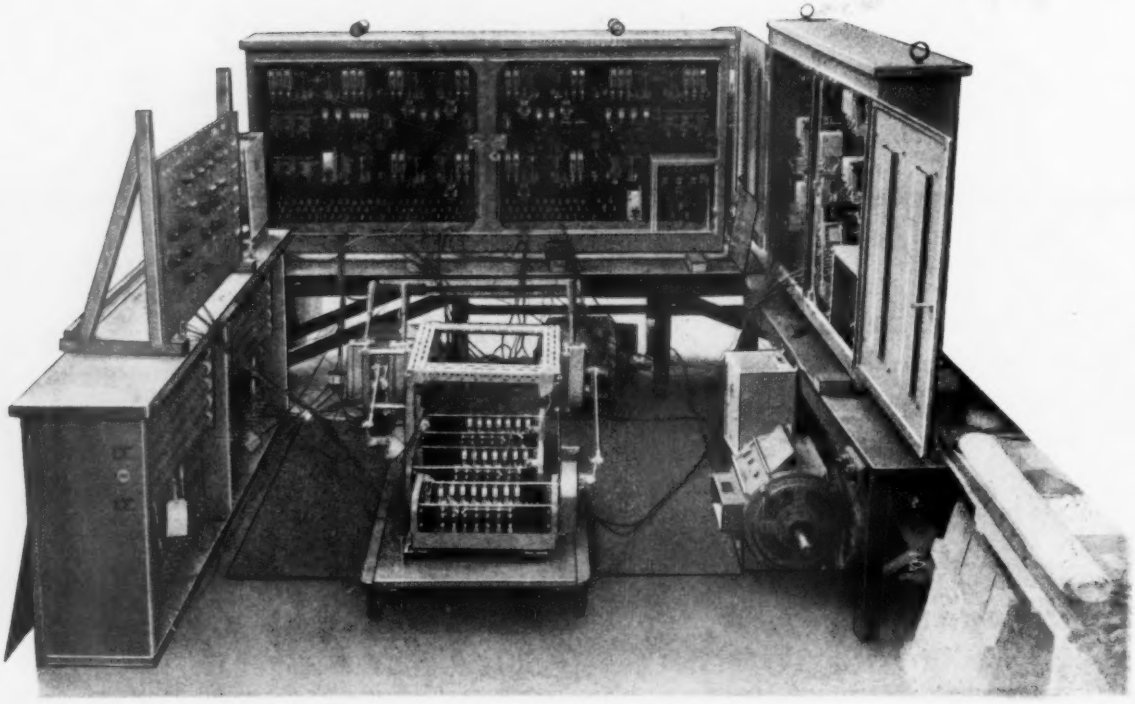

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

BOROUGH OF HESTON AND ISLEWORTH

Street Lighting Improvement

WELLINGTON ROAD NORTH AND WELLINGTON ROAD SOUTH HOUNSLOW (B358)

TENDERS are invited for the installation of street lighting to Group "A" standard in Wellington Rd North and Wellington Rd South, Hounslow (B.358) from Bath Rd, Hounslow, to Hanworth Rd, Hounslow.

The work includes the removal of 35 No. existing columns and the supply and erection of 44 No. steel columns with mercury fluorescent (colour corrected) lamps, lanterns and control gear.

On deposit of £2 2s (returnable if a bona fide tender is received and not withdrawn) the Bill of Quantities, Specification and Form of Tender may be obtained from, and the conditions of contract and drawings seen at the Borough Engineer's Dept., 88 Lampton Rd, Hounslow.

Tenders, in endorsed envelopes supplied by the Corporation but not indicating the tenderer, must be delivered to me by 10 a.m. on Friday, 11 March, 1960.

The Corporation are not bound to accept any tender.

D. MATHIESON,
Town Clerk.

Town Hall,
Hounslow, Middlesex. (P 165)

CITY AND COUNTY OF BRISTOL

Main Foul Water Drainage Scheme

MAIN PUMPING STATION ANCILLARY EQUIPMENT

MANUFACTURERS suitably experienced for the supply of:

(a) Curved bar sewage screens approx. 9 ft x 11 ft together with automatic raking gear and pumps for flushing water.

(b) Hand and automatically operated penstocks of 60 in., 42 in. and 36 in. square opening and 12 in. and 9 in. diameters.

(c) Comminutors to deal with a sewage flow of 20,000,000 gallons/day for each unit.

(d) Electrically operated 10-ton overhead crane and hand-operated 5-ton overhead crane.

(e) Metering equipment for incoming and outgoing sewage flows, sewer and sump level indicators, transmission and recording equipment.

are invited to apply for inclusion in a selected list of firms who will be invited to tender for the supply and erection of the above equipment.

Applications, together with supporting evidence of similar experience, to City Engineer and Planning Officer, Cabot Hse, Deanery Rd, Bristol 1, by 7 March. (P 184)

BOROUGH OF WREXHAM

NEW GUILDHALL

Tenders for Internal Telephone System

THE Wrexham Town Council proposes to consider a list of Firms/Companies to be invited to tender for the supply and installation of an Internal Telephone System (P.A.X.) at its New Guildhall now in course of erection.

Firms/Companies with experience of such Contracts are invited to submit their

continued in next column

continued from previous column

names with particulars of similar work to the undersigned by not later than Monday, 29 Feb., 1960.

Tender documents will be forwarded to Contractors nominated by the Council.

PHILIP J. WALTERS,
Town Clerk.

Guildhall,
Wrexham.
9 Feb., 1960. (P 171)

APPOINTMENTS VACANT

CENTRAL ELECTRICITY GENERATING BOARD

South Western Division

Vacancy SW/AV/22/60.

CHIEF DRAUGHTSMAN

REQUIRED in the Electrical Department at Divisional Headquarters, Bristol.

Superannuation scheme. Salary: N.J.B. Schedule D, Grade 2, £1,180/£1,305 per annum.

The successful candidate will be required to take charge of a Drawing Office providing engineering, cartographical and general services. Responsible experience in leading a team of draughtsmen engaged on the layout of electrical plant and equipment is essential. Experience of high-voltage transmission systems will be an advantage. Technical education to H.N.C. desirable.

Previous applicants need not re-apply.

Closing date: 29 Feb., 1960.

Vacancy SW/AV/23/60.

FOURTH ASSISTANT ENGINEERS

Required in the Divisional Electrical Department for maintenance operations, site works supervision and commissioning of plant.

Superannuation scheme. Salary: Class AX/DX, Grade 7, £840—£965/£1,040 per annum.

Candidates should possess qualifications leading to A.M.I.E.E. and should have had experience in the testing of both primary and secondary electrical equipment on the transmission system and in generating stations.

Closing date: 4 March, 1960.

Applications on form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be returned to him by the date stated, together with any additional information in support of the application. (P 180)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

APPLICATIONS are invited for the post of SENIOR ASSISTANT ENGINEER in the Construction Section at No. 2 Sub-Area Headquarters.

Applicants should have a wide experience of Electricity Distribution with a Supply Authority, and possess appropriate technical qualifications.

The basic grade for the post is N.J.B., K/4, £1,470/£1,575 per annum, and the starting salary will be determined accordingly.

Special application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, nr. Northwich, Cheshire. Closing date: 4 March, 1960. (P 173)

FEDERATION OF RHODESIA AND NYASALAND

Federal Power Board

APPLICATIONS are invited for the following appointment:

ASSISTANT PROTECTION ENGINEER
SHERWOOD CONTROL CENTRE
SALARY: £1,750.

Applicants should be Chartered Electrical Engineers or have qualifications leading to Associate Membership of our recognised Engineering Institution, and should be experienced in the testing associated with the commissioning and maintenance of power station and main transmission line plant protection, including modern Feeder, Transformer, Generator and Bus Zone Schemes.

The successful applicant will be stationed at Sherwood Control Centre. Housing and hard furniture will be provided by the Board, at a reasonable rental in the town of Que Que (where there is a full range of Federal Government Schools), about 16 miles from Sherwood. Transport between Sherwood and Que Que will be provided.

The reasonable travelling and removal expenses of successful candidates and their families to Que Que will be paid by the Board.

There is a pension scheme which the successful applicant will be required to join.

Applications giving full details of education, training, experience, age and marital status should be posted so as to reach the Secretary, Federal Power Board, Reliance Hse, P.O. Box 630, Salisbury, Southern Rhodesia, not later than 26 March, 1960. (P 182)

BIRMINGHAM REGIONAL HOSPITAL BOARD

CLERK OF WORKS
(MECHANICAL AND ELECTRICAL)

REQUIRED. Salary scale: £660 x £20(1) x £25(4)—£780 per annum. Practical experience in electrical installation and heating and ventilating trades (wide experience in one or other) and suitable technical training to supervise site installations in accordance with specifications and drawings desirable. Superannuable. Apply (quoting ENG 1) to Secretary, 10 Augustus Rd, Birmingham 15, by 7 March, 1960. (P 160)

CENTRAL ELECTRICITY GENERATING BOARD

North Eastern and Yorkshire Region

ELECTRICAL ENGINEER

APPLICATIONS are invited for the appointment of Senior Electrical Engineer in the Regional Research and Development Department with Headquarters in Leeds. The successful candidate will be responsible to the Regional Research and Development Officer for the work of a small section dealing with problems associated with power generation and transmission. He will be expected to co-operate with other sections in the department dealing with physics, metallurgy, mechanical engineering and statistics and with other engineers engaged on operational work within the Region.

The duties will include the initiation, assessment and direction of various research and development projects on problems associated with overhead conductors, cables, outdoor high-voltage equipment, studies of arc behaviour and investigations of surface insulation faults.

Applicants should have a good engineering degree, or equivalent qualifications and at least three years' research experience.

The salary for the appointment, which is superannuable, will be in accordance with N.J.B. Agreement Schedule B, Grade 2 or 3 (£1,365/£1,740) and will commence at a point commensurate with qualifications and experience.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), North Eastern and Yorkshire Region, Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 7 March, 1960. (P 179)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2 before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD
East Midlands Division

APPLICATIONS are invited for the following positions within the Division:

FOURTH ASSISTANT ENGINEER
COVENTRY SECTION
Vacancy No. 18/60/ET.

Applicants should have experience of the maintenance and operation of E.H.T. overhead lines, transformers and switchgear.

Preference will be given to candidates with qualifications leading to Corporate Membership of the Institution of Electrical Engineers.

Salary will be in accordance with Class AX/EX, Grade 8 (£735/£960 per annum), of the National Joint Board Agreement.

Closing date for receipt of applications: 26 Feb., 1960.

PLANT SHIFT CONTROL ENGINEERS
DRAKELOW "A" POWER STATION
Vacancy No. 19/60/ET.

Experience desirable in control of boilers and turbines at high pressure and temperature, pulverised fuel, together with electrical control room experience.

Technical qualifications to Higher National Standard desirable.

Salary will be in accordance with Class J, Grade 10 (£910/£955 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 26 Feb., 1960.

GENERAL ASSISTANT ENGINEERS
HIGH MARNHAM POWER STATION
Vacancy No. 20/60/ET.

Applications are invited from suitably qualified men who are interested in Power Station operation and/or maintenance as a career.

Facilities are available whereby experience can be obtained in all sections of a large modern power station, and the prospects of advancement are real to those who are willing to take advantage of the opportunities.

The salary during the initial training period will depend upon qualifications and knowledge and will be within the range £560/£700 per annum of the National Joint Board Agreement.

Closing date for receipt of applications: 26 Feb., 1960.

ASSISTANT SHIFT CHARGE ENGINEER
BURTON-ON-TRENT POWER STATION
Vacancy No. 29/60/ET.

Applicants should possess H.N.C. or equivalent qualifications and have experience in Power Station operation.

Salary will be in accordance with Class E, Grade 9 (£765/£810 per annum), of the National Joint Board Agreement, plus £90 per annum shift allowance.

Closing date for receipt of applications: 4 March, 1960.

ASSISTANT SHIFT CHARGE ENGINEER
DRAKELOW "B" POWER STATION
Vacancy No. 30/60/ET.

Applicants should have received a sound technical training and have had experience in a modern power station. Preference will be given to candidates who possess the Higher National Certificate, or its equivalent.

Salary will be in accordance with Class J, Grade 8 (£1,025/£1,085 per annum), of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 4 March, 1960.

FIRST ASSISTANT CHEMIST
COVENTRY POWER STATION
Vacancy No. 31/60/ET.

Candidates should have previous laboratory experience in a power station and should possess the Higher National Certificate in Chemistry.

Salary will be in accordance with Class G, Grade 9 (£860/£905 per annum), of Schedule A of the National Joint Board Agreement.

Closing date for receipt of applications: 27 Feb., 1960.

These appointments will be pensionable

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within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Divisional Establishments Officer, Central Electricity Generating Board, East Midlands Division, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated.

O. S. WOODS,
Divisional Controller.
10 Feb., 1960. (P 150)

EASTERN ELECTRICITY BOARD
Northmet Sub-Area

30/60.R.

DISTRICT ENGINEER, ST. ALBANS
(Ref. 927)

CANDIDATES should have had wide experience in the planning, construction, operation and maintenance of overhead and underground distribution systems, including substations, and should be capable of organising and supervising the engineering work of the District.

Corporate Membership of the Institution of Electrical Engineers will be an advantage.

Salary: N.J.B., Class G, Grade 3 (£1,270/£1,360).

The successful candidate will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Apply by letter to F. J. Drake, ASSOCIATE I.E.E., Manager, Eastern Electricity Board, 107 St. Peter's St. St. Albans, Herts, by 29 Feb., 1960. (P 167)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Kincardine Generating Station

APPLICATIONS are invited for a superannuable position as SHIFT CHARGE ENGINEER at the above Station.

Applicants should have had considerable experience in a responsible position of the operation of modern turbo-alternator plant and high-pressure boilers. Experience with pulverised fuel firing and unit operation is also desirable. Candidates should be in possession of a Higher National Certificate, or have equivalent qualifications, and preferably, be Corporate Members of one of the Senior Engineering Institutions.

Arrangements are being made to provide housing accommodation for the successful applicant.

The salary will be in accordance with Schedule A to the National Joint Board Agreement, i.e., Class K, Grade 6, £1,270/£1,360 per annum, rising ultimately to Class M, Grade 6, £1,470/£1,575 per annum, in both instances, plus shift allowance of 10%.

Applications, on the standard form, quoting reference G7/60, should be submitted to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 4 March, 1960. (P 166)

CENTRAL ELECTRICITY GENERATING BOARD
South Wales Division

Vacancy No. 27/ET/60.

APPLICATIONS invited for superannuable N.J.B. appointment of DRAUGHTSMAN in the CONSTRUCTION UNIT of the GENERATION DEPARTMENT at DIVISIONAL HEADQUARTERS.

Salary: D.3, £1,055/£1,155 per annum: or D.4, £930/£1,030 per annum, according to qualifications and experience.

Applicants should be suitably qualified and have experience in Civil Engineering and Building Works for H.V. Sub-stations, including design and detailing of reinforced concrete foundations, piling, road and drainage schemes.

The work will necessitate visits to sites within the Division for preparation of scheme extensions.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 4 March, 1960. (P 149)

SOUTH OF SCOTLAND ELECTRICITY BOARD

APPLICATIONS are invited for a superannuable position as a THIRD ASSISTANT ENGINEER in the Generation Operation Section of the Chief Engineer's Department at Board Headquarters.

Applicants should, preferably, be in possession of technical qualifications leading to Corporate Membership of a recognised professional Institution, and should have had practical experience in a Steam Power Station.

Salary: N.J.B., Schedule B, Class AX/DX, Grade 6, £925/£1,140 per annum.

Applications, quoting reference E11/60, should be submitted on the standard form to the Secretary, South of Scotland Electricity Board, Inverlair Ave, Glasgow S.4, not later than 26 Feb., 1960. (P 159)

CENTRAL ELECTRICITY GENERATING BOARD
North Eastern and Yorkshire Region

ASSISTANT SHIFT CHARGE ENGINEER
FERRYBRIDGE "B" POWER STATION

APPLICATIONS are invited for the appointment of Assistant Shift Charge Engineer at Ferrybridge "B" Power Station.

The salary for the appointment will be in accordance with the National Joint Board Agreement, Schedule A, Grade 8, Class K (£1,095/£1,170 per annum), plus a 10% allowance for shift duties.

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 29 Feb., 1960. (P 143)

UNIVERSITY COLLEGE OF SWANSEA

ENGINEERING CLERK OF WORKS

ENGINEERING Clerk of Works required by the University College of Swansea to supervise a number of Mechanical and Electrical Sub-contracts in connection with building developments at the College. Candidates must be not less than 30 years of age and possess technical qualifications up to National Certificate standard. Mechanical and/or Electrical Engineering or be Graduate or Associate Members of the Institution of Electrical Engineers or I.H.V.E.

Preference will be given to applicants who have experience and knowledge of electrical installations and also good previous experience in site supervision of engineering works.

The inclusive salary will be in the range of £1,000/£1,150 per annum according to experience. Applications should be addressed to the Architects, Sir Percy Thomas and Son, 10 Cathedral Rd, Cardiff, giving full particulars of age, qualifications and experience. The closing date for applications is 27 Feb., 1960. (P 113)

CENTRAL ELECTRICITY GENERATING BOARD
North Eastern and Yorkshire Region

DEPUTY STATION SUPERINTENDENT
SKELTON GRANGE "B" POWER STATION

APPLICATIONS are invited for the appointment of Deputy Station Superintendent, Skelton Grange "B" Power Station, near Leeds. (Capacity 4 by 120 MW-480 MW.)

Applicants should have good engineering qualifications and experience in the control of a large modern Power Station.

The salary for appointment will be in accordance with the National Joint Board Agreement, Schedule A, Class L, Grade 2 (£1,865/£1,985 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 29 Feb., 1960. (P 144)

Box Number replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

SOUTHERN ELECTRICITY BOARD

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

READING District of No. 2 (Newbury) Sub-Area. Salary N.J.B., Class J, Grade 10 (£910 x £15—£955 per annum). N.J.B. conditions of service.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations, and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1165, not later than 29 Feb., 1960.

SENIOR ACCOUNTING ASSISTANT
(INCOME)

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.C., Grade 5 (£885 x £25—£960 per annum). N.J.C. conditions of service.

Candidates must have experience of the Electricity Supply Industry and in particular of meter reading, billing and collection of accounts. The successful candidate will be responsible to the District Accounting Officer for the operation of the Income Section of the District accounting organisation and must be capable of the control and supervision of staff.

Applications on forms obtainable from the Sub-Area Secretary, Lower Drayton La, Cosham, Portsmouth, and returned to him, quoting Z.1146, not later than 29 Feb., 1960.

GENERAL ASSISTANT ENGINEERS
(TWO VACANCIES)

Bournemouth District of No. 4 (Bournemouth) Sub-Area. Salary N.J.B., Class J, Grade 11 (£860 x £15—£905 per annum). N.J.B. conditions of service.

The successful candidates will be required to give general assistance in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks. Applicants should have had sound experience in Electricity Supply Distribution and the possession of suitable technical qualifications would be an advantage. The successful candidates will be required to carry out standby duties if and when called upon to do so.

Applications on forms obtainable from the Sub-Area Secretary, 1 Priory Rd, Bournemouth, and returned to him, quoting Z.1162, not later than 29 Feb., 1960.

ASSISTANT ENGINEER
(MAINTENANCE AND OPERATION)

Swindon District of No. 2 (Newbury) Sub-Area. Salary N.J.B., Class F, Grade 10, £765/£810 per annum, with N.J.B. conditions of service, but present trends indicate that the District may be reclassified to Class G from 1 April, 1960.

The duties of the post will be to assist with the maintenance and operation of H.V. and L.V. distribution mains and substations and with minor construction work. A technical training to H.N.C. standard and experience of similar work are required.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1024, not later than 29 Feb., 1960.

ENGINEERING DRAUGHTSMAN
(CIVIL)

Sub-Area Engineering Department of No. 2 (Newbury) Sub-Area. Salary N.J.B., Grade 6, Schedule D (£620 x £20—£740 per annum). N.J.B. conditions of service.

Applicants should have had a good technical training and be experienced in the preparation of plans and detailed drawings of buildings and civil engineering works, including substations, service centres, workshops and offices.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1149, not later than 29 Feb., 1960.

GENERAL ASSISTANT ENGINEER

Reading District of No. 2 (Newbury) Sub-Area, located at High Wycombe. Commencing salary N.J.B., Class J, Grade 16, £610 per annum rising to £700 per annum, maximum of Grade 15. N.J.B. conditions of service.

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The duties of the post will be to assist with distribution including minor construction and general maintenance of H.V. and L.V. overhead and underground distribution systems, substation plant, etc. Applicants should possess suitable technical qualifications.

Applications on forms obtainable from the Sub-Area Secretary, 7 Oxford Rd, Newbury, Berks, and returned to him, quoting Z.1163, not later than 29 Feb., 1960.

The successful candidates for the above appointments will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible. (P 175)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Fife Area

SECOND ASSISTANT ENGINEER
CONSTRUCTION

APPLICATIONS are invited for this post at Area Headquarters, Dunfermline. Applicants should have practical experience of the construction of lines and substations up to 33 kV and technical training up to Higher National Certificate standard.

Conditions of employment in accordance with the National Joint Board Agreement, Schedule A, present classification being Class H, Grade 7:: post superannuable, subject to satisfactory evidence of health.

Applications on standard form, obtainable from the Area Manager, S.S.E.B., East Port, Dunfermline, should be returned to him not later than 2 March, 1960. (P 178)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

SHIFT CHARGE ENGINEERS

REQUIRED at Rugeley Power Station, nr. Rugeley, Staffs. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade L6, £1,360/£1,450 per annum, plus 10% shift allowance.

A sound technical training and practical experience in the operation and maintenance of steam generating plant and main switchgear in a large modern power station are required. The station is one of advanced design. Appropriate qualifications an advantage.

Apply, quoting Vacancy No. 27/60MD on form AE6 available from Establishment Officer, 53 Wake Green Rd, Moseley, Birmingham 13, by 29 Feb., 1960. (P 176)

SOUTH EASTERN ELECTRICITY BOARD

CARTOGRAPHIC DRAUGHTSMAN
WOKING DISTRICT

SALARY £205/£590 per annum according to age and experience. Superannuable. Applicants should have a sound general education and a knowledge of drawing office routine. Experience in the reproduction of Ordnance Survey maps would be an advantage.

Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, 4 Chobham Rd, Woking, by 2 March, 1960.

SHOWROOM ASSISTANT
(MALE OR FEMALE)
KINGSTON DISTRICT

Annual salary £205/£505 or £590 plus London Weighting according to age and qualifications. Knowledge of electrical apparatus and experience in selling and dealing with consumers' enquiries an advantage. Duties include cashiering. This appointment is primarily for the Kingston showroom, but the person appointed must be prepared to work in any of the Kingston District showrooms.

Applications, quoting ET and naming two referees, on forms from District Manager, Seeboard, 22 Claremont Rd, Surbiton, Surrey, by 2 March, 1960.

GEORGE WRAY,
Secretary.
(P 174)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 33/ET/60.

APPLICATIONS are invited for the Superannuable N.J.B. appointments of Third or Fourth Assistant Engineers in the Generation Department, Divisional Headquarters.

Salary (according to duties and responsibilities): AX/DX, Grade 6, £925/£1,140 p.a.; AX/DX, Grade 7, £840/£1,040 p.a.; AX/DX, Grade 8, £735/£935 p.a.

The successful applicants, who will be required to work on research problems associated with efficient power generation, will be based at Divisional Headquarters, but their duties will involve working for long periods at various Power Stations.

Applicants should have good technical qualifications, leading to Associate Membership of one of the major Institutions and it is essential that they have experience in modern power station plant.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 4 March, 1960. (P 190)

THE NORTH WESTERN ELECTRICITY BOARD

Draughtsman

(a) ENGINEERING DEPARTMENT
UNION STREET, OLDHAM

(b) STALYBRIDGE DISTRICT

APPLICANTS should have had sound drawing office experience and a good technical education.

Salary scale: £620 x £20—£740 per annum. Schedule D, Grade 6, N.J.B. conditions.

Applications, naming three referees and stating post applied for, to Manager, No. 3 Sub-Area, North Western Electricity Board, Union St, Oldham, by 27 Feb., 1960. (P 177)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

Vacancy No. 31/ET/60.

APPLICATIONS are invited for the superannuable N.J.B. appointment of MAINTENANCE ENGINEER (MECHANICAL) at Newport Power Station, Mon.

Salary: F.6, £965/£1,025 p.a.

Applicants should have had wide experience in Power Station Mechanical Maintenance and should preferably be Corporate members of the Institution of Mechanical Engineers, or hold equivalent qualifications.

Application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 4 March, 1960. (P 161)

THE NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:

1. Wear Sub-Area

CHESTER-LE-STREET DISTRICT
ONE SECOND ASSISTANT DISTRICT ENGINEER

2. Harrogate Sub-Area

HARROGATE DISTRICT
ONE SECOND ASSISTANT DISTRICT ENGINEER
WITH LOCATION AT DACRE

Applicants should be suitably qualified engineers, with experience in the construction, operation and maintenance of overhead and underground networks and associated plant and equipment.

Salary for both appointments: Schedule A, Class F, Grade 7, £910/£955. N.J.C. conditions of service.

Applications stating age, qualifications and experience, to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne, within ten days of the appearance of this advertisement. (P 181)

YORKSHIRE ELECTRICITY BOARD

Head Office

CHIEF ENGINEER'S DEPARTMENT
SENIOR ASSISTANT ENGINEERS

APPLICATIONS are invited from suitably qualified and experienced engineers for the following positions in the Chief Engineer's Department:

Senior Assistant Engineer in the System Design Section. The duties are concerned mainly with the planning of the Board's 66 and 33 kV systems.

Senior Assistant Engineer in the Operation and Measurements Section, on the measurements side. The duties are to carry out technical work in the measurements field, which includes protection, communications and electronics.

Salaries: N.J.B., Schedule B, Class AX-EX, Grade 1, £1,600 x £25—£1,725/£1,865, per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to The Secretary, Yorkshire Electricity Board, Wetherby Rd, Scarcroft, nr. Leeds, not later than 7 March, 1960.

No. 3 (Sheffield) Sub-Area

ROTHERHAM DISTRICT
FOURTH ASSISTANT DISTRICT ENGINEER

Applicants should have had experience in the work of a District Engineering Department.

They should hold the Higher National Certificate in Electrical Engineering or an equivalent qualification.

Salary: N.J.B. Class J, Grade 11, £860 x £15—£905 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial Street, Sheffield, not later than 4 March, 1960.

No. 4 (Leeds) Sub-Area

FOURTH ASSISTANT ENGINEER
(METERS, TESTING AND PROTECTION)
THREE POSTS

Applicants should possess the Higher National Certificate in Electrical Engineering or equivalent qualifications and should have served a recognised engineering apprenticeship.

Experience in the work of a Protection, Metering and Telecommunications Section would be an advantage.

Salary: N.J.B., Class L, Grade 13, £860 x £15—£905 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 4 (Leeds) Sub-Area, Yorkshire Electricity Board, Bramhope, nr. Leeds, not later than 4 March, 1960.

No. 6 (Hull) Sub-Area

FOURTH ASSISTANT ENGINEER
(METERS, TESTING AND PROTECTION)

Applicants should be in possession of the Higher National Certificate in Electrical Engineering and have received a regular training in electrical engineering. Some experience in the industry subsequent to training is required. The work is varied and interesting and offers opportunities of gaining valuable experience.

Salary: N.J.B., Class L, Grade 13, £860 x £15—£905 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston upon Hull, not later than 4 March, 1960.

No. 1 (Bradford) Sub-Area

KEIGHLEY DISTRICT
THIRD ASSISTANT DISTRICT ENGINEER

Applicants should have passed the Associate Membership Examination of the Institution of Electrical Engineers, or hold equivalent qualifications, and have experience in construction, operation and maintenance of high voltage systems, underground cables and overhead lines and substations, and medium low voltage networks.

continued in next column

continued from previous column

Candidates should be prepared to reside within the District and undertake standby duties.

Salary: N.J.B., Class F, Grade 9, £815 x £15—£860 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53 Sunbridge Rd, Bradford, not later than 4 March, 1960. (P 183)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Birmingham & District Sub-Area

THIRD ASSISTANT ENGINEER
(COMMON SERVICE CONTROL SECTION, BIRMINGHAM AND DISTRICT SUB-AREA AND MIDLANDS DIVISION)

Duties involve assisting in the control, whilst on shift, of all operations on the Sub-Area High Voltage and Medium Voltage systems and control functions in connection with the operation of plant in Hams Hall "A" and "B" Generating Stations, Nechells Generating Station and 132 kV Bulk Supply Points. Technical qualifications desirable. Salary: £1,095/£1,170 per annum plus shift enhancement when appropriate (N.J.B., Grade M.10). Apply, by letter, within 14 days, stating age, experience, present position and salary to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, Birmingham and District Sub-Area, 14 Dale End, Birmingham 4.

North Staffs. Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER
(STOKE SOUTH DISTRICT)

Duties include the construction, operation and maintenance of H.V. and L.V. Mains and Substations, and applicants should have had experience in the planning of system reinforcements and mains extensions. Technical qualifications desirable. Salary: £860/£905 per annum (N.J.B., Grade G.9).

GENERAL ASSISTANT DISTRICT ENGINEER
(STOKE SOUTH DISTRICT)

Applicants will be required to assist and should have had experience in the planning, construction and maintenance of H.V. and L.V. overhead and underground mains. Technical qualifications desirable. Salary: £765/£810 per annum (N.J.B., Grade G.11).

Apply, by letter, within 14 days, stating age, experience, present position and salary to Mr C. C. Pimble, Sub-Area Manager, Midlands Electricity Board, 234 Victoria Rd, Fenton, Stoke-on-Trent.

South Staffs. and North Worcs. Sub-Area

SECOND ASSISTANT ENGINEER
(MAINTENANCE)
(HEADQUARTERS)

Applicants should have had experience in the commissioning, testing and maintenance of major plant and in maintenance of urban and rural networks, including fault location. Technical qualifications desirable. Salary: £1,270/£1,360 per annum (N.J.B., Grade L.7). Apply, by letter, within 14 days, stating age, education, qualifications, experience, present position and salary to Mr H. A. P. Caddell (Ref. EMI/SEC), Midlands Electricity Board, P.O. Box No. 9, Toll End Rd, Tipton, Staffs.

F. W. CATER,
Secretary.
(P 162)

ELECTRICAL ENGINEER/DESIGNER required by BARRON AND CROWTHER LTD., EASTLEIGH, HANTS.

Applicant should have theoretical and practical knowledge of electrical drives and associated control devices. Some knowledge of electronic controls and equipment would be an advantage. Education should be up to H.N.C. standard minimum.

Prospects and conditions of employment are good and there are several attractive residential areas within easy reach of the factory.

Apply in writing to: The Secretary, Barron and Crowther Ltd., Woodside Rd, Eastleigh, Hants. (P 142)

ELECTRICAL MANAGER (ASSISTANT)

Clyde Shipyard building all types Merchant and Naval vessels requires Assistant Electrical Manager undertaking control of Drawing Office, Plant and Ship installations. Previous experience of A.C. systems essential. Candidates should have at least H.N.C. or equivalent qualifications. Good prospects of early promotion. Excellent Staff Pension and Life Assurance Schemes; house available. Applications stating age, detailed experience, technical qualifications and salary required, write **2710, William Porteous and Co., Glasgow.** (P 59)

ELECTRICAL CONTRACTORS in Surrey require an ESTIMATING and SUPERVISING ENGINEER for contracts up to £5,000. Write in confidence, stating experience and salary required to Box 7731, Electrical Times. (P 186)

ELECTRICAL ENGINEER required for Glasgow office staff. Applicants should have completed post graduate training in manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (P 185)

South Western ELECTRICITY

SOUTH WESTERN ELECTRICITY BOARD

Applications are invited for the following positions:

Fourth Assistant District Engineer Sidmouth Branch, Exeter District

Salary according to Class G, Grade 10, £815 x £15—£860 per annum, of the N.J.B. Agreement.

The successful candidate will be responsible for organising the installation of services and small mains extensions, and the maintenance of the Branch distribution system. He will be required to carry out Engineering Standby duties, and also to organise the Contracting activities in the Branch.

Candidates must have drive and initiative. Possession of a current driving licence is desirable.

Applications for the above post to be made on standard form AE6/ACT obtainable by postcard only from the District Manager, South Western Electricity Board, 3 Bedford St, Exeter. Closing date for receipt of completed applications is 7 March, 1960.

Third Assistant District Engineer (Planning) Torbay

Salary within Class G, Grade 9, £860 x £15—£905 per annum, of the N.J.B. Agreement.

The successful candidate will be required to assist in the preparation of capital applications and plans for rural and urban mains extensions up to and including 33 kV, together with planning work on new housing estates and industrial projects. His duties will also include the preparation and serving of statutory notices on local authorities, and making applications to the Ministry of Power for consent to erect overhead lines. The person appointed may be required to undertake standby duties.

Possession of the Higher National Certificate in Electrical Engineering is desirable and a current driving licence will be an advantage.

Applications for the above post to be made on standard form AE6/ACT obtainable by postcard only from the District Manager, South Western Electricity Board, Electric Hse, Union St, Torquay. Closing date for receipt of completed applications is 7 March, 1960.
(P 187)

ELECTRICAL MAINTENANCE FOREMAN for Light Engineering Factory in South Devon. Must be experienced in all aspects of factory power distribution, together with installation and maintenance of all electrical plant and machinery, including electronics. Age 35-50. State salary required.—Apply Box 7725, Electrical Times. (P 156)

AN OPPORTUNITY IN IRON AND STEEL

BISRA

ENGINEERS AND PHYSICISTS

are required by the Plant Engineering and Energy Division for research on Steelworks Plant.

The positions to be filled provide interesting and varied work, and call for a capacity for original thought coupled with enthusiasm and drive to encourage the application of research results in iron and steel works.

Candidates should be Graduates or Corporate Members of an appropriate institution. Experience in the steel industry is not essential, but some experience in a heavy engineering industry is an additional advantage.

The Division's headquarters are at the London Laboratories in Battersea, but the research staff make frequent visits to works and the Association's other Laboratories.

Applications are invited for the following positions:

1. AN ELECTRICAL ENGINEER to lead a team working on problems of automatic control of heavy electrically or hydraulically driven plant. The applicant should have a good knowledge of servomechanism theory and some experience of using harmonic response equipment or analogue simulators. Experience with heavy electrical plant is preferred. Starting salary in the range £1,075/£1,425 or higher for a particularly suitable candidate. (Quote reference "E.E.2".)

2. AN ELECTRICAL ENGINEER for work on automatic control of heavy plant. An interest in servomechanisms and some experience in this field is essential. Starting salary up to £1,000. (Quote reference "E.E.3".)

3. TWO RESEARCH WORKERS for the investigation of problems connected with the use of energy in steelworks processes. Qualifications in mechanical or chemical engineering would be suitable, or qualifications in physics or electrical engineering with an interest in heating problems. Experience in any of the following would be an advantage: fluidised beds, induction heating, temperature measurement, heat transfer mechanisms, combustion processes, or thermal properties of materials. Starting salary up to £1,050, but one post might qualify for a higher salary for a particularly suitable candidate. (Quote reference "E.N.4".)

4. A CIVIL or **MECHANICAL ENGINEER,** with experience in stress measurement or steel structures, to work on the recording of stresses in cranes and steelworks buildings with a view to improved design methods. Starting salary up to £1,050. (Quote reference "E.17".)

Applications should be made in writing, quoting the appropriate reference number, to the Personnel Officer, The British Iron and Steel Research Association, 11 Park Lane, London W.1.

(P 168)

BRITISH Enka LIMITED

PRODUCERS OF MAN-MADE FIBRES

ELECTRICAL ENGINEER

Required as Senior Assistant to the Chief Electrical Engineer in a large, modern plant. Experience of installation, maintenance, and operational work of E.H.T. and M.V. systems and ability to organise and handle labour essential. Minimum qualifications A.M.I.E.E. or equivalent. The successful applicant must be able to take over in the absence of the Chief and a good salary will accordingly be paid.

The Company is extending its activities by the production of Cellulose Films and the prospects of advancement are good.

Pension Scheme with facilities for transfer. Assistance with housing.

Applications, in confidence, should state age, qualifications, experience in sequence and be addressed to Personnel Manager.

BRITISH ENKA LTD.
AINTREE, LIVERPOOL.

(P 154)

CONTRACTS ENGINEER, preferably under 40 and of H.N.C. standard, required for inside Sales Staff of Electric Switchgear Manufacturers. Preference given to applicants with experience of switchgear and motor control gear. Excellent prospects. Non-contributory pension scheme. Write, giving age and full particulars of education, qualifications, experience and salary requirements to the Personnel Manager, George Ellison Ltd., Perry Barr, Birmingham 22B. (P 152)

ELECTRICAL TESTERS. The type of men we require should have previous experience of testing Control Gear, be capable of working with the minimum of supervision, and have a clear understanding of the principles of electric motors. Five-day week, canteen, pension fund. Apply in writing stating age, previous experience, etc., to Personnel Officer, Dewhurst and Partner Ltd., Inverness Rd, Hounslow, Middx. (P 141)

ELECTRICAL TEST ENGINEER required by rubber and plastic cable makers, London area. Write stating age, experience and salary required.—Box No. 7727, Electrical Times. (P 169)

IF YOU

Are young and enthusiastic.
Wish to join an expanding organisation.
Have electrical degree or H.N.C. with some experience of H.V. laboratory work, and

ASPIRE

to Technical Sales Appointment after initial period on development projects, with opportunities to travel, send details of education and experience to date to:

DOULTON INDUSTRIAL PORCELAINS LTD.

Ref. MCB/HV.,
Doulton House,
Albert Embankment,
Lambeth, London, S.E.1.

(P 155)

AN FLECTRICAL DESIGNER

for A.C. Rotating Machines preferably with experience of Medium/Large motors required by firm of Electrical Engineers in county town within easy reach of London. Salary according to qualifications. Contributory pension scheme in operation. Applications which will be treated in strictest confidence should be sent to: Box No. 7719, Electrical Times. (P 145)

INSTALLATION CHARGE-HANDS required for installing lighting, heating and power and maintenance on construction sites. Box No. 7723, Electrical Times. (P 147)

JUNIOR ELECTRICAL ENGINEERING ASSISTANT, to work with Engineer preparing drawings and specifications for installations on Industrial and Commercial buildings generally. Write stating age, experience and qualifications, if any, to: L. J. Schwarz and Partners, Eagle Hse, High St, Wimbledon S.W.19. (P 153)

PORT ELIZABETH invites applications from ELECTRICAL ENGINEERS for the post of "Technical Engineer". Total emoluments including the present cost of living allowance will be between £1,372 and £1,498 per annum for married men and between £1,177 and £1,302 per annum for single men.

Candidates should be University Graduates or Corporate Members of a recognised Institution of Electrical Engineers or possess similar qualifications.

The responsibilities of the post will include the preparation of specifications, reports and statistics relating to the electricity undertaking.

Other Conditions of Service or arrangements regarding interview can be obtained by writing to Davis and Soper Ltd., 52 and 54 St. Mary Axe, London E.C.3, to whom applications should be submitted on or before 4 March, 1960. (P 151)

OPPORTUNITY for KEEN YOUNG ENGINEER with sales acumen to make future for himself with established company specialising in maintenance of overhead lines. Successful applicant would be based in London and would undertake extensive travel throughout U.K. to maintain liaison with Electricity Boards and other nationalised industries in order to negotiate progressive volume of business. The vacancy is one of appeal to those who already have experience in overhead lines and also salesmanship talents which they are anxious to develop. Car provided and pension scheme operative. Write in confidence giving full particulars. Box No. 7721, Electrical Times. (P 146)

SALES ENGINEERS

PERMALI LTD. have vacancies on outside Sales Staff in London and Manchester for younger men age 30-35, to assist Area Manager in sale of insulating materials and components to heavy electrical and electronic equipment manufacturers. Good educational standard with knowledge of or preferably practical experience in electrical industry required. Previous sales experience not essential. Good prospects for promotion.

Apply, in strict confidence, giving full details of education and career, to:

Sales Manager,
Permali Ltd.,
Bristol Rd, Gloucester

(P 163)

QUALIFIED ELECTRICAL DESIGN ENGINEER required to work in Jamaica on power and lighting schemes for building projects. Work includes design and supervision. Some knowledge of other building services and air conditioning an advantage. Apply in writing giving full details of age, experience and U.K. salary required (successful candidate will work in London office initially) to: Norman and Dawbarn, Architects and Consulting Engineers, 7 Portland Pl, London W.1. (P 108)

SAO PAULO LIGHT S.A.—SERVICOS DE ELETRICIDADE, a Company in Brazil and a Subsidiary of the Canadian Corporation Brazilian Traction, Light and Power Co. Ltd., invite applications from suitably qualified men for the position of SHIFT CHARGE ENGINEER in the Piratininga Power Station. The power station, put into service about five years' ago, is situated near Sao Paulo (pop. over three millions: temperate climate: 2,200 ft above sea level). The plant comprised initially 2 x 80 MW 1,800 r.p.m. steam turbo-alternator units, each supplied at 850 psi, 900°F by one 850,000 lb/hr oil-fired boiler and is now being expanded by the addition of two 125,000 kW reheat units, 1,800 psi, 1,000°F. Applicants should have a sound technical knowledge and wide experience of the operation of modern turbines and boilers, preferably with oil or pulverised-fuel firing; should also have an aptitude for supervision and the maintenance of harmonious labour relations. Good salary, three years' agreement with first-class passage both ways, with family: four months' paid leave after three years' service. Written application in the first instance should be made to Mr Osborne Mitchell, General Manager, Canadian-Brazilian Services Ltd., 9/12 Cheapside, London E.C.2. (P 172)

SENIOR ENGINEER required to take charge of building services design teams. Candidates to be thoroughly experienced in all aspects of building services work, particularly in the design of heating, ventilating and electrical services. Minimum qualification Associate Membership of the Mechanical or Electrical Institutions. The successful candidate will be considered for the position of Associate with this firm. Applications giving age, experience and salary required to: Norman and Dawbarn, Architects and Consulting Engineers, 7 Portland Pl, London W.1. (P 109)

SENIOR and INTERMEDIATE ELECTRICAL DESIGNER/DRAUGHTSMEN required, experienced in all classes of installation work for Hospitals, Schools, Industrial Premises, etc., including the preparation of Specifications and Contract Documents.

Salary commensurate with experience.

Write to Hoare, Lea and Partners, Consulting Engineers, Shenstone Hse, Upper Park Rd, Manchester, 7. (P 191)

APPOINTMENTS WANTED

CAPABLE ELECTRICAL ENGINEER (28), returning to India and keen to take up responsible duties, wishes to discuss possibilities with interested organisations. Hard-working and years of experience with British manufacturers. Please write for details.—Box No. 7707, Electrical Times. (P 95)

NEON TECHNICIAN. — First-class Bender/Sc. Blower, exp. all types H.V. pumps and H.V. elec. equip. ins. and op. University demonstrator and tech. Requires app. Home or abroad F/C refs.—Box No. 7695, Electrical Times. (P 25)

PATENTS

THE proprietor of British Patent No. 614373, entitled "IMPROVEMENTS IN ELECTRIC DRY BATTERIES," offers same for licence or otherwise to ensure its practical working in Great Britain. Inquiries to Singer, Stern and Carlberg, Chrysler Bldg, New York 17, New York, U.S.A. (P 93)

THE Proprietors of British Patent No. 759324 for "IMPROVEMENTS RELATING TO ELECTRIC FURNACES" are desirous of entering into negotiations for the sale of the Patent, or for the grant of a licence thereunder. Communications should be addressed to Page, White and Farrer, 27 Chancery La, London W.C.2. (P 157)

THE Proprietors of British Patent No. 739,332, for "SPLIT POLE PARALLEL DIELECTRIC HEATING BONDING PROCESS," desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder.—Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London W.C.2. (P 164)

AGENCIES

LANCASHIRE and Cheshire. Well-established MANUFACTURER'S AGENT, with live connection with Wholesalers, Electricity Boards and Electrical Contractors, requires additional lines in Domestic and Installation Products.—Box No. 7729, Electrical Times. (P 170)

Large switchgear manufacturing company (2,000 workers) in EFTA country, specialising in L.T. equipment for

SINGLE-PHASING PREVENTION AND EARTH LEAKAGE PROTECTION

(including Core Balance Devices)

SEEKS REPRESENTATION

in Great Britain through well-established firm with trained staff and efficient sales organisation. Co-operation with British switchgear manufacturer, to complement his own selling programme by offered products might eventually be considered.

Enquiries should be sent to:

Box No. 7713, Electrical Times.

(P 115)

FACTORIES FOR SALE

COLCHESTER, ESSEX. New single-storey factory to be erected on 3-acre corner site with valuable frontage to main Harwich Rd. Will provide about 60,000 sq ft. Companies and organisations interested to rent or purchase apply Developers, 18 Upper Brook St, London W.1. (P 189)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (P 1)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines). — Service Electric Co. Ltd., Stanmore, Middx. (P 2)

P.V.C. EXTRUSIONS FOR THE TRADE. Esco (Rubber) Ltd., 34/36 Somerford Grove, London N.16. (P 148)

FOR SALE

A.C. and D.C. SLOTMETERS: Time Switches and Quarterly Meters. Single and polyphase, 2½—100 amps. Tested and guaranteed 2 years. Television and Billiards Meters. — Tradex Meter Co., Surbiton, Elmbridge 4487. (P 9)

A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi 5105, 67 Rothschild Rd, W.4. (P 3)

A.C. and D.C. MOTORS, GENERATORS from stock.—Service Electric Co. Ltd., Honeypot La, Stanmore, Middx. Edgware 5566/9. (P 4)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit Breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512-3-4. Stores at Chobham, Surrey. (P 7)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (P 5)

FOR LIGHTING GLASS, contact Stevens and Williams Ltd., Tipton, Staffs. Anything in Opal, decorated, pressed or blown, for domestic, commercial and street lighting. Largest exclusive lighting glassworks in the world. Buy British. (P 11)

"HUMPHRIES" TYPE OC-B OPEN-FRONTED UPRIGHT ROLL FEED PRESS for sale. Adjustable stroke, 5/16 in. to 2 in. Pressure exerted, 10 tons. Bed 14½ in. x 9½ in. Double left to right roll feed, feed rolls 2½ in. long x 2 in. diameter. Complete with two coil holders. Arranged motor drive 400/3/50. Photo, etc., from F. J. Edwards Ltd., 359 Euston Rd, London N.W.1, or 41 Water St, Birmingham 3. (P 188)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectreis, Dept. E.T. Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (P 8)

PURLEY CHOKES AND BALLASTS. Our 80-W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (P 6)

SECOND-HAND Electrical Plant can be as good as new if you buy it from specialists. Write for our stock list. Dynamo and Motor Repairs Ltd., North End Rd, Wembley Pk, Middlesex. Telephone: Wembley 3121: Soho Rd, Handsworth, Birmingham. Telephone: Birmingham Northern 0898. (P 10)

50 K.V.A. GENERAL MOTORS, 27½ K.V.A. and 187 K.V.A. Generating Sets.—B.G. Plant (Sales Agency) Ltd., Watlington, Oxon, Watlington 44. (P 158)

Power-made to measure!

The ever-increasing demand for electricity must be met and, if this country is to survive as a prosperous and expanding industrial nation, it must be met as economically as possible.

The problem is being solved in two ways—by increased technical efficiency in normal power station operation and by development of nuclear power. New power stations, whether they burn coal or depend on nuclear energy, are progressively more and more efficient.

Coal will long continue to be our main source of power. The present surplus is only temporary. In the foreseeable future the expanding demand for power will exceed the available supply of home-produced coal. That is why Britain has a nuclear power programme which is the largest and most progressive in the world.

CEGB

THE CENTRAL ELECTRICITY GENERATING BOARD

INDEX TO ADVERTISERS

A.E.I. Lamp & Lighting Co. Ltd. *Cover* (i)
Allen West & Co. Ltd. 6
Associated Electrical Industries Ltd. (Motor & Control Gear Division) ... 5
Associated Electrical Industries Ltd. (Cable Division) 25
Associated Electrical Industries Ltd. (Heavy Plant Division) 33
Associated Electrical Industries Ltd. (Instrumentation Division) 38
Associated Electrical Industries Ltd. (Transformer Division) 43

Backer Electric Co. Ltd. 8
British Driver-Harris Co. Ltd. ... 11
British Insulated Callender's Cables Ltd. 29
British Klockner Switchgear Ltd. ... 18
Brook Motors Ltd. 52
Bullers Ltd. 17

Cable Strippers Ltd. 54
Central Electricity Generating Board... 51
Channel Conduits Ltd. 41
Contactor Switchgear Ltd. 54
Crompton Parkinson Ltd. 55

Dowling, David, Ltd. 41

Electrical Times Ltd. 54
E.M.B. Co. Ltd. 44
English Electric Co. Ltd. 23
Erskine, Heap & Co. Ltd. 4
Evershed & Vignoles Ltd. 19

Ferranti Ltd. 30

General Electric Co. Ltd. ... 24, 35, 56
Genristo Ltd. 34
Gillott, C. H. E., Ltd. 3

Hackbridge Cable Co. Ltd. 9
Hawker Siddeley Group 53
Higgs Motors Ltd. 14

Kautex Ltd. 34

Lock, A. M., & Co. Ltd. 26
London Electric Firm Ltd. 42
London Electric Wire Co & Smiths Ltd. 16
Low, Duncan, Ltd. 52
Lumitron Ltd. 26

Metway Electrical Industries Ltd. ... 7
Midland Electric Manufacturing Co. Ltd. 32

Nettle Accessories Ltd. 15

Oddie, Bradbury & Cull Ltd. 18

Parmiter, Hope & Sugden Ltd. *Cover* (iii)
Permali Ltd. 2
Pirelli-General Cable Works Ltd. ... 10
Pitman, Sir Isaac, & Sons Ltd. 18
Plessey Co. Ltd. 31, 37
Preformed Line Products (Great Britain) Ltd. 20

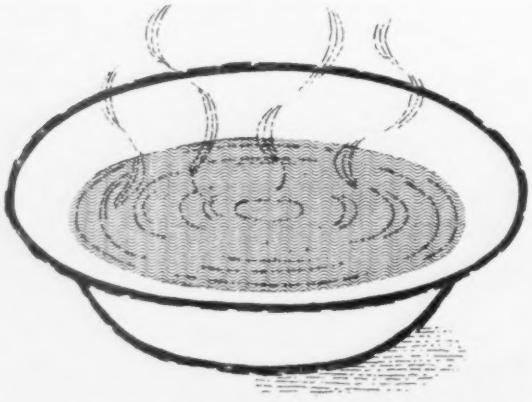
Research & Control Instruments Ltd.... 28
Reyrolle, A., & Co. Ltd. 40

Scholes, Geo. H., & Co. Ltd. ... *Cover* (ii)
Scottish Cables Ltd. ... ... *Cover* (iv)
Sheen (Nottingham) Ltd. 42
Square D. Ltd. 27
Standard Telephones & Cables Ltd. ... 13
Stream-Line Filters Ltd.... 12
Sturdy Electric Co. Ltd. 41
Sutcliffe, Speakman & Co. Ltd. ... 28

T.M.C. Harwell (Sales) Ltd. 36

Vitality Bulbs Ltd. 54

Whitecross Co. Ltd., The 7
Wolverhampton Die-Casting Ltd. ... 1
Wootton & Co. Ltd. 15



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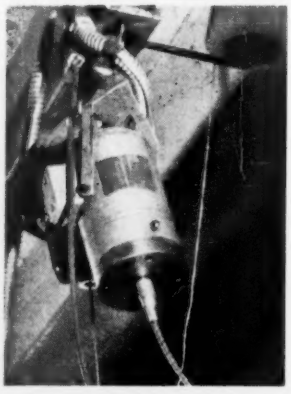

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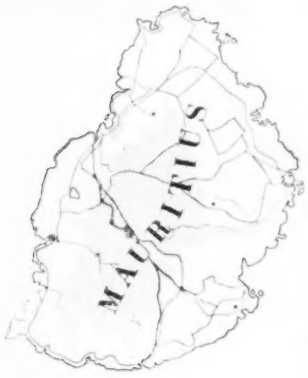

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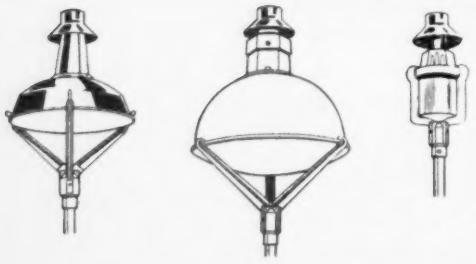
School Keeper servicing fittings at 20 feet

Photo by courtesy London County Council



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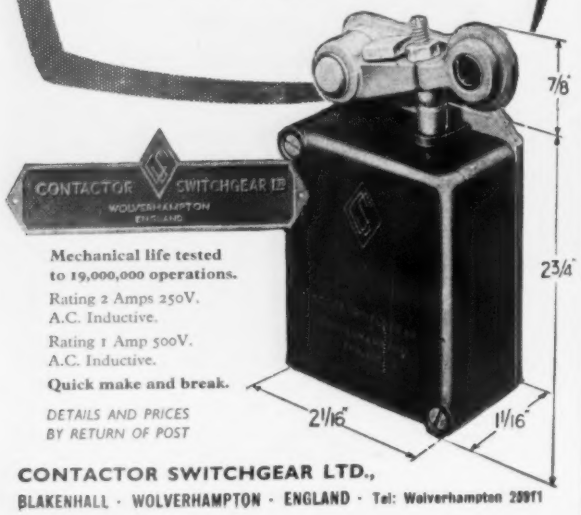

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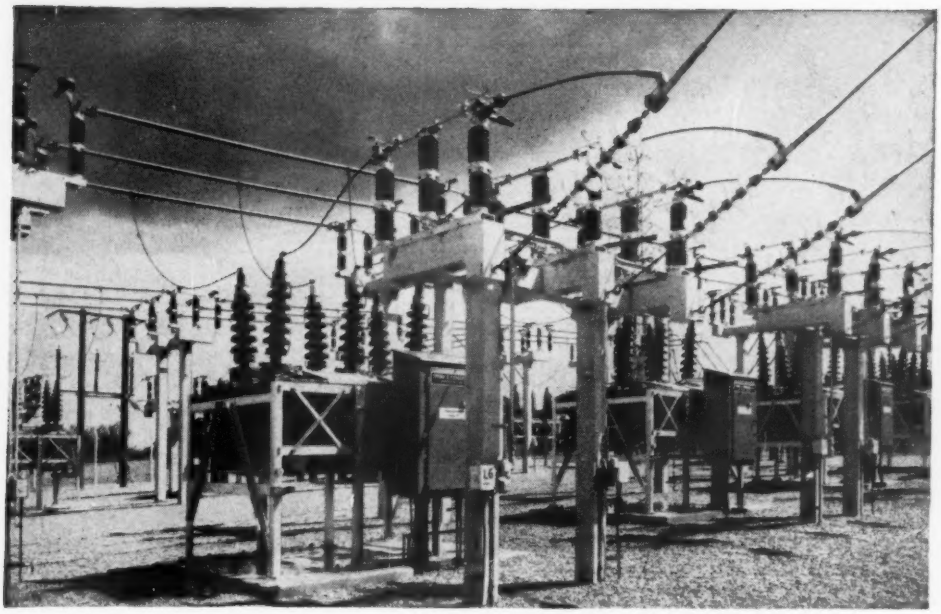

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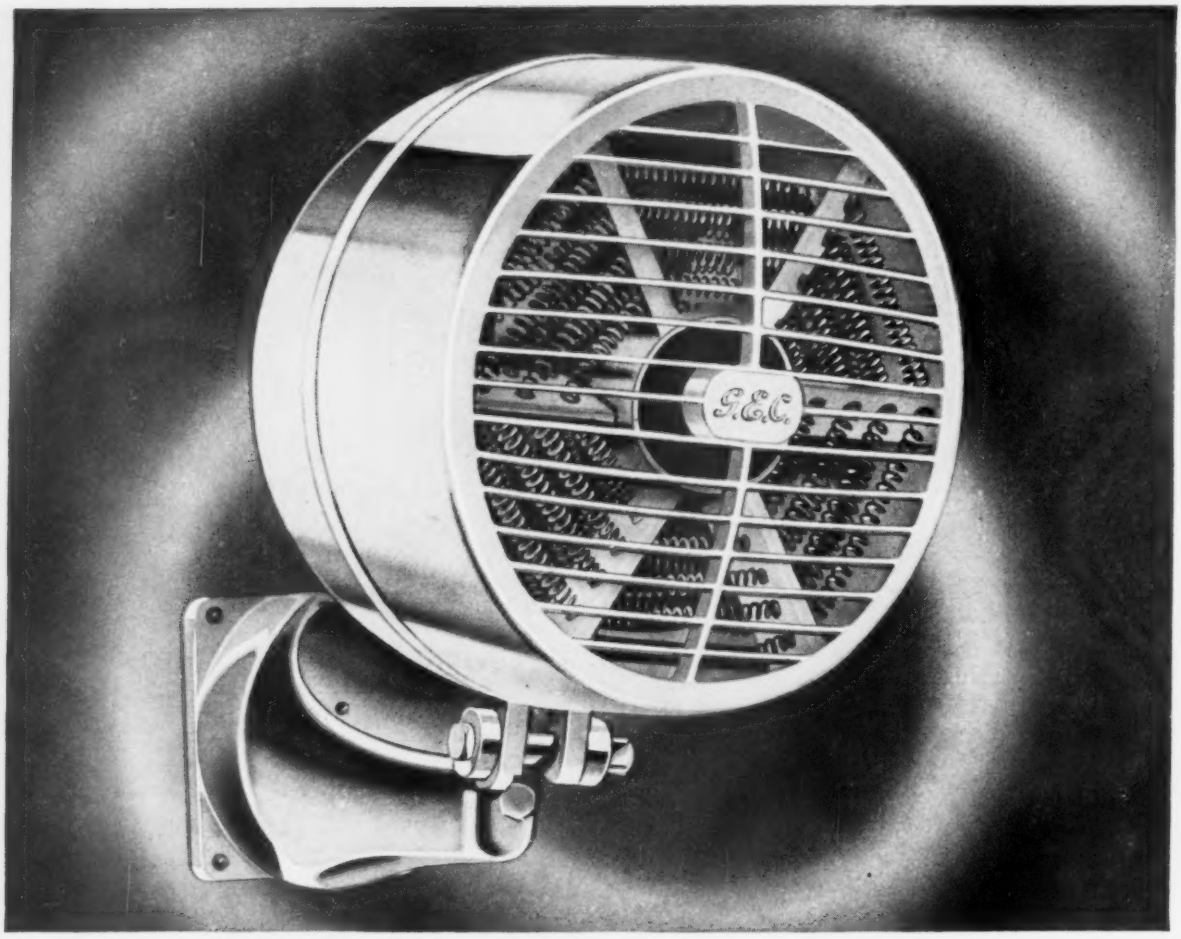

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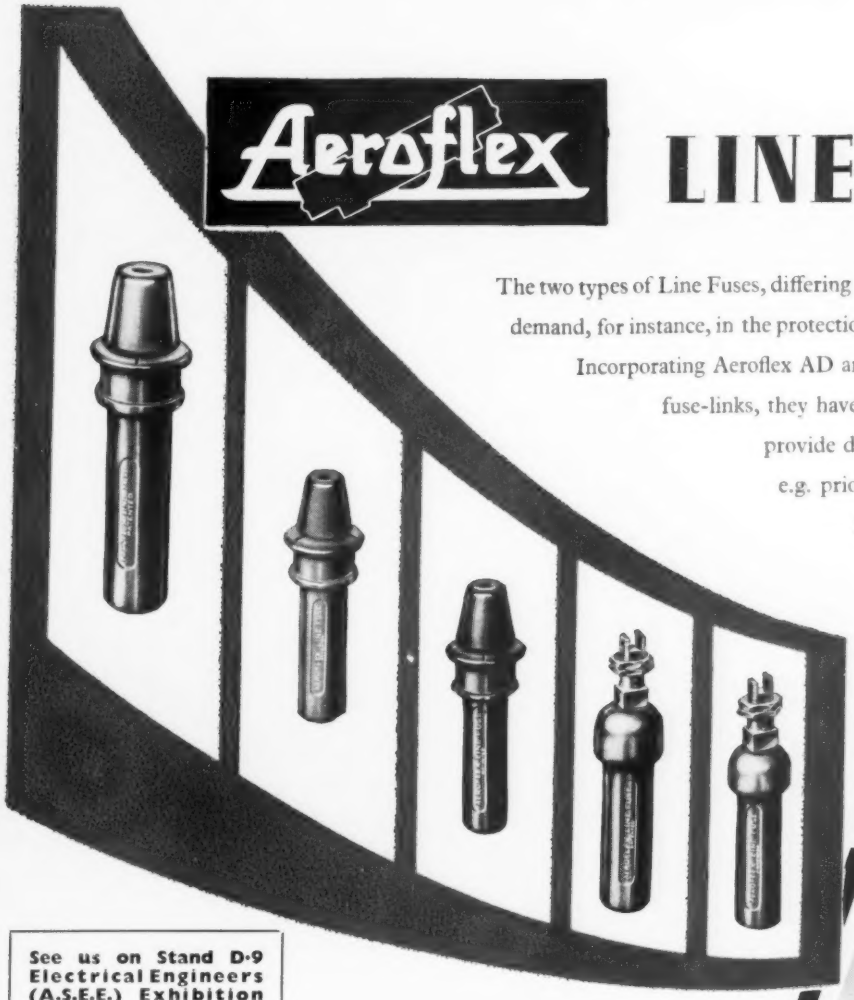
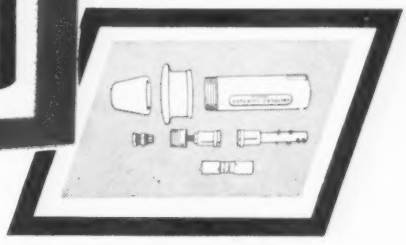
LINE FUSES

The two types of Line Fuses, differing only in connection, meet a steady demand, for instance, in the protection of pole-mounted transformers. Incorporating Aeroflex AD and FC type rewireable cartridge fuse-links, they have the characteristics necessary to provide discriminatory reaction to faults; e.g. priority can be given to consumers' fuses on house service cut-outs.



The subject is fully dealt with in our publication No. AL2.



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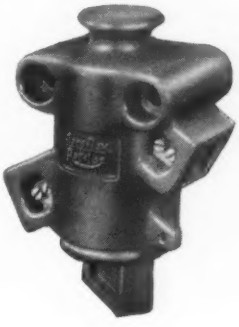
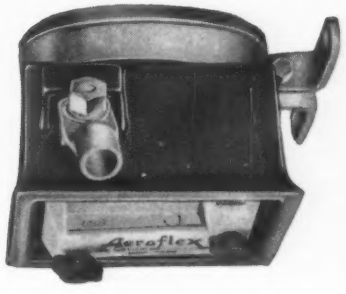
OVERHEAD LINE FUSES

The illustration shows examples from a considerable range of overhead line fuses to suit different situations:—on the left an Aeroflex 60 amp. Rotaloc line fuse is shown, suitable for securing to the cross bar of a line support, and having an adaptable fuse handle carrying an Aeroflex high breaking capacity 60 amp. ADS type rewireable cartridge fuse-link. The right hand illustration shows a 200 amp. porcelain enclosed line fuse, embodying Link Type handle with Aeroflex Ceram high breaking capacity rewireable cartridge fuse-link.





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